High frequency microphone measurements for transition detection on airfoils. Risø B1-18 appendix report

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Publication date:
2008

Document Version
Publisher's PDF, also known as Version of record

RISØ

Risø-R-Report

High Frequency Microphone Measurements for Transition Detection on Airfoils
Risø B1-18 Appendix Report

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Risø–R–1645(App.1)(EN)

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May 2008

DTU

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Title: High Frequency Microphone Measurements for Transition Detection on Airfoils - Risø B1-18 Appendix Report

Department: Aeroelastic Design - Wind Energy Department

Risø–R–1645(App.1)(EN)
May 2008

Abstract:
This report is an appendix to [1]. A comprehensive set of results are presented which allows the transition on airfoils to be detected. Results for the Risø B1-18 profile are presented.

ISSN 0106-2840
ISBN 978-87-550-3675-8

Contract no.:
ENS 033001/33033-0055

Group's own reg. no.:
1110060-04

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Contents

List of symbols

σ	Sample standard deviation [Pa]
α	Angle of attack [deg]
x	Chordwise position [m]
Re	$\frac{cU}{\nu}$ Reynolds number [-]
P_s	Power spectrum of $\mathbf{Y}$ [Pa]
f_1, f_2	High and lower bound of filtered σ [Hz]
μ_n	Statistical moments of P_s of order n [Hz]
x	Chordwise coordinate (positive from leading edge to trailing edge) [m]
x_{tr}	Transition point [m]
c	Chord length [m]
$0.5\rho U^2$	Dynamic pressure [Pa]
U	Incoming velocity (in windtunnel) [m/s]
ν	Kinematic viscosity [m^2/s]

1 Introduction

For a full introduction refer to [1].

Important information !

In figures where XFoil data is presented the filenames are also given and the corresponding simulation parameters can be found in section 3. In XFoil the transition point is calculated at the same Reynolds and Mach number as the experiment it is compared to, but in most cases a free transition is specified (corresponding to a clean profile) even though roughness etc. is used in the experiment.

If the following is specified, it means that the standard deviation of pressure fluctuations σ is calculated as the sample standard deviation

$$f_1 = 0\,\text{Hz}, f_2 = 25000\,\text{Hz}$$

If the following is specified, σ is calculated using Fourier data and the values are lower than the physical data. Refer to [1] for details.

$$f_1 = 2000\,\text{Hz}, f_2 = 25000\,\text{Hz}$$

2 Table of data

The Log-file names are abbreviated.

Re	Tag	Description	Grid[mm]	Log-file
1.60e6	Re16a	Clean	-	Log 2007-10
	Re16b	ZZ90 x/c=5% suc. x/c=10% press.	-	Log 2007-10
	Re16c	LM standard LER. ZZ 2%	-	Log 2007-10
	Re16d	Trip wire. Bump tape 2%	-	Log 2007-10
	Re16e	Clean	-	Log 2007-10
	Re16f	Clean	200x200	Målelog_mandag
	Re16fII	Clean	200x200	Målelog_mandag
	Re16g	ZZ90 x/c=5% suc. x/c=10% press.	200x200	Målelog_tirsdag
	Re16h	LER. ZZ 2%	200x200	Målelog_tirsdag
	Re16i	Trip wire. Bump tape 0,1 2%	200x200	Målelog_tirsdag
	Re16j	Clean	100x100	Målelog_onsdag,torsdag
	Re16k	ZZ90 x/c=5% suc. x/c=10% press.	100x100	Målelog_onsdag,torsdag
	-	LER. ZZ 2%	-	-
	Re16m	Trip wire. Bump tape 0,1 2%	100x100	Målelog_onsdag,torsdag
3.00e6	Re3a	Clean	-	Log 2007-10
	Re3b	ZZ90 x/c=5% suc. x/c=10% press.	-	Log 2007-10
	Re3c	LM standard LER. ZZ 2%	-	Log 2007-10
	Re3d	Trip wire. Bump tape 2%	-	Log 2007-10
	Re3e	Clean	-	Log 2007-10
	Re3f	Clean	200x200	Målelog_mandag
	Re3g	ZZ90 x/c=5% suc. x/c=10% press.	200x200	Målelog_tirsdag
	Re3h	LER. ZZ 2%	200x200	Målelog_tirsdag
	Re3i	Trip wire. Bump tape 0,1 2%	200x200	Målelog_tirsdag
	Re3j	Clean	100x100	Målelog_onsdag,torsdag
	Re3k	ZZ90 x/c=5% suc. x/c=10% press.	100x100	Målelog_onsdag,torsdag
	-	LER. ZZ 2%	-	-
	Re3m	Trip wire. Bump tape 0,1 2%	100x100	Målelog_onsdag,torsdag
4.00e6	Re4a	Clean	-	Målelog_onsdag,torsdag
5.00e6	Re5a	Clean	-	Målelog_onsdag,torsdag
6.00e6	Re6a	Clean	-	Log 2007-10
	Re6b	ZZ90 x/c=5% suc. x/c=10% press.	-	Log 2007-10
	Re6c	LM standard LER. ZZ 2%	-	Log 2007-10
	Re6d	Trip wire. Bump tape 2%	-	Log 2007-10
	-	Clean	-	-
	Re6f	Clean	200x200	Målelog_mandag
	Re6g	ZZ90 x/c=5% suc. x/c=10% press.	200x200	Målelog_tirsdag
	Re6h	LER. ZZ 2%	200x200	Målelog_tirsdag
	Re6i	Trip wire. Bump tape 0,1 2%	200x200	Målelog_tirsdag
	Re6j	Clean	100x100	Målelog_onsdag,torsdag
	Re6jII	Clean	100x100	Målelog_onsdag,torsdag
	Re6k	ZZ90 x/c=5% suc. x/c=10% press.	100x100	Målelog_onsdag,torsdag
	-	LER. ZZ 2%	-	-
	Re6m	Trip wire. Bump tape 0,1 2%	100x100	Målelog_onsdag,torsdag

Log 2007-10.pdf = LM Wind Tunnel Log 2007-10 cRIO000 to cRIO489.pdf

Målelog_mandag.pdf = Målelog_mandag_week41.pdf

Målelog_tirsdag.pdf = Målelog_tirsdag_week41.pdf

Målelog_onsdag,torsdag.pdf = Målelog_onsdag,torsdag_week41.pdf

3 Table of XFoil data

Re	*M*	file	N_{crit}	Forced x_{tr}
1.60e6	0.08	B118Re16M08Ncr9.pol	9	-
		B118Re16M08Ncr8.pol	8	-
		B118Re16M08Ncr6.pol	6	-
		B118Re16M08Ncr4.pol	4	-
3.00e6	0.15	B118Re30M15Ncr9.pol	9	-
		B118Re30M15Ncr8.pol	8	-
		B118Re30M15Ncr6.pol	6	-
		B118Re30M15Ncr4.pol	4	-
4.00e6	0.20	B118Re40M20Ncr9.pol	9	-
		B118Re40M20Ncr8.pol	8	-
		B118Re40M20Ncr6.pol	6	-
		B118Re40M20Ncr4.pol	4	-
5.00e6	0.25	B118Re50M25Ncr9.pol	9	-
		B118Re50M25Ncr8.pol	8	-
		B118Re50M25Ncr6.pol	6	-
		B118Re50M25Ncr4.pol	4	-
6.00e6	0.30	B118Re60M30Ncr9.pol	9	-
		B118Re60M30Ncr8.pol	8	-
		B118Re60M30Ncr6.pol	6	-
		B118Re60M30Ncr4.pol	4	-

Table 1: XFoil datafiles

If not otherwise stated the following boundary layer parameters have been used.

`Vacc`	0.0100
`Klag`	5.6000
`Uxwt`	1.00
`A`	6.7000
`B`	0.7500
`KCt`	0.01485
`CtiniK`	1.8000
`CtiniX`	3.3000

Table 2: XFoil parameters

4 Suction side

4.1 Re16a Clean -

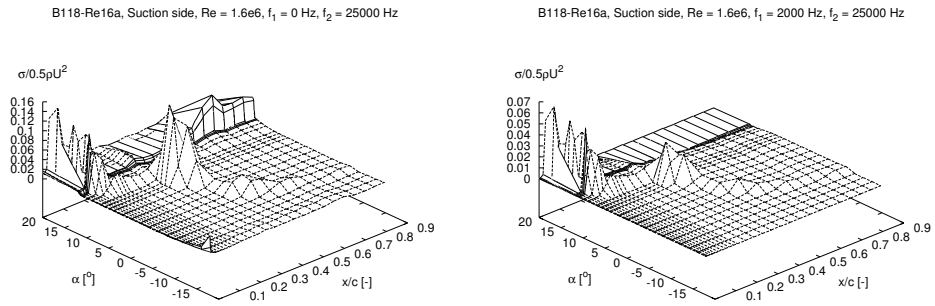

Figure 1: Pressure standard deviations, σ

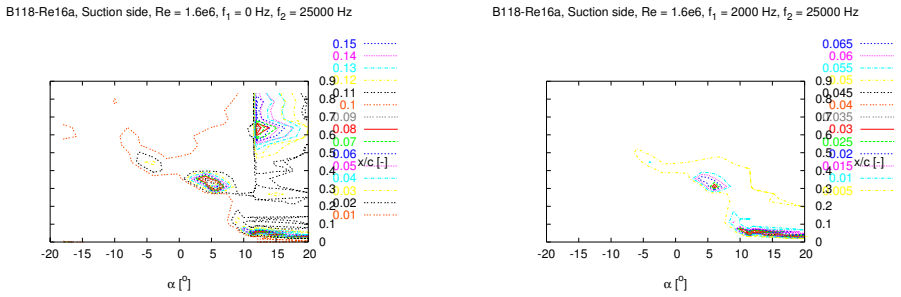

Figure 2: Contours of σ

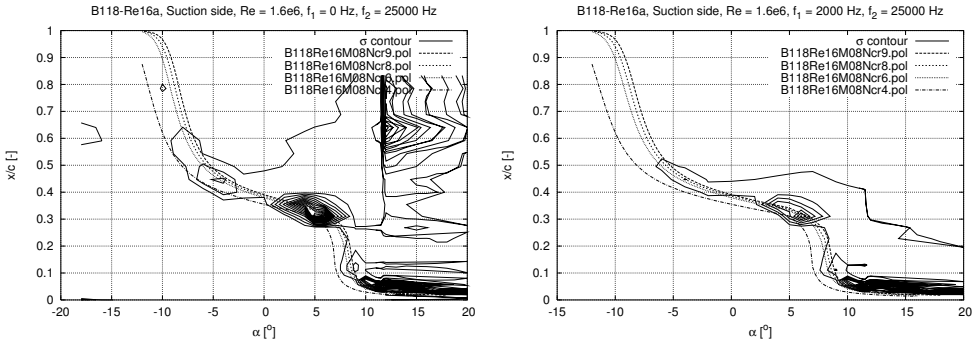

Figure 3: Contours of σ and XFoil data

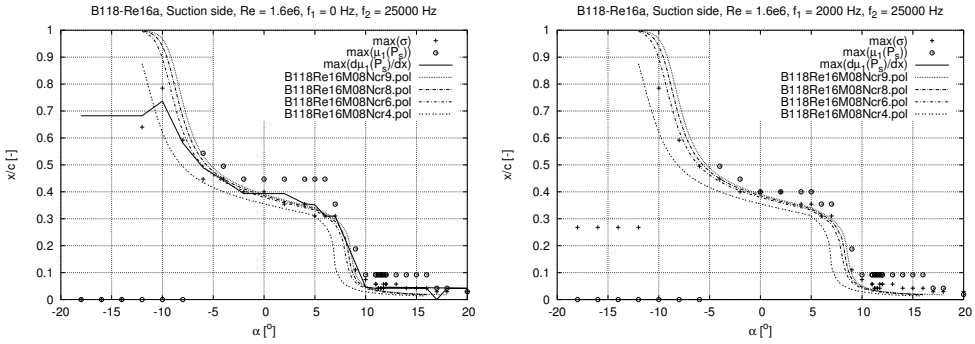

Figure 4: Transition detection

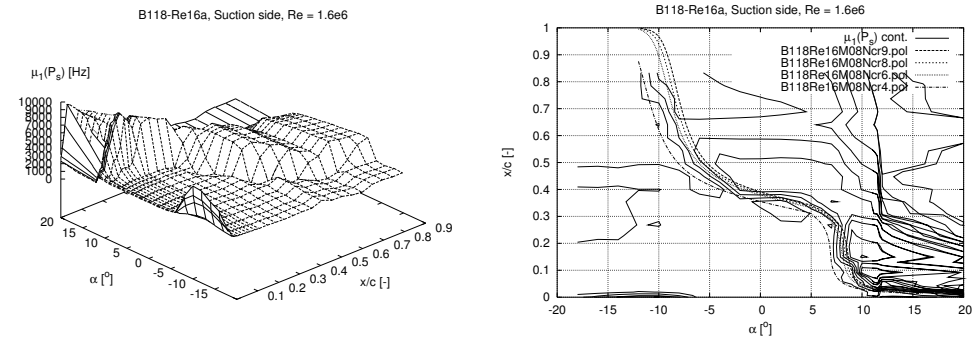

Figure 5: Fourier transform mean, $\mu_1(P_s)$

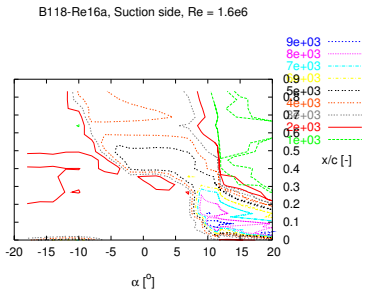

Figure 6: Contours of $\mu_1(P_s)$

```
B118-Re16a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823      6136.3    3479.2
-16.00  0.6823      5736.6    5305.7
-14.00  0.6823      7098.1    6049.6
-12.00  0.6823      8180.0    6885.1
-10.00  0.7367     26517.2    7033.4
 -8.00  0.5818     21194.2    5167.9
 -6.00  0.4897     38151.9    4870.2
 -4.00  0.4437     44199.6    5374.8
 -2.00  0.3935     38087.4    5712.9
  0.00  0.3935     45594.3    5843.0
  2.00  0.3935     48335.4    5808.7
  4.00  0.3558     47212.5    5804.4
  5.00  0.3516     40487.5    5808.5
  6.00  0.3098     35478.5    5829.1
  7.00  0.3098     47383.8    6049.3
  9.00  0.1339     61437.0    8839.5
 10.00  0.0460     78317.4    9589.4
 11.00  0.0419     82855.5    9901.1
 11.25  0.0419     82465.9    9882.9
 11.50  0.0419     81660.5    9830.2
 11.75  0.0419     82502.4    9635.5
 12.00  0.0419     85360.8    9462.6
 13.00  0.0419     81251.8    9084.2
 14.00  0.0419     80177.3    8966.6
 15.00  0.0419     77974.0    8800.0
 16.00  0.0419     76489.2    8678.0
 17.00  0.0000     77029.5    8806.6
 18.00  0.0419     70233.5    8991.5
 20.00  0.0419     63832.6    9412.6
 12.00  0.0460     83179.8    9351.5
 11.75  0.0460     82877.6    9485.6
 11.50  0.0419     81656.4    9865.0
 11.25  0.0419     82334.2    9899.4
 11.00  0.0419     83041.5    9918.6
```

4.2 Re16b ZZ90 x/c=5% suc. x/c=10% press. -

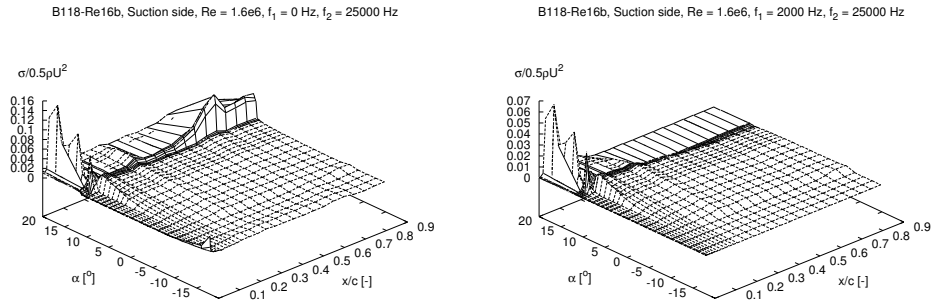

Figure 7: Pressure standard deviations, σ

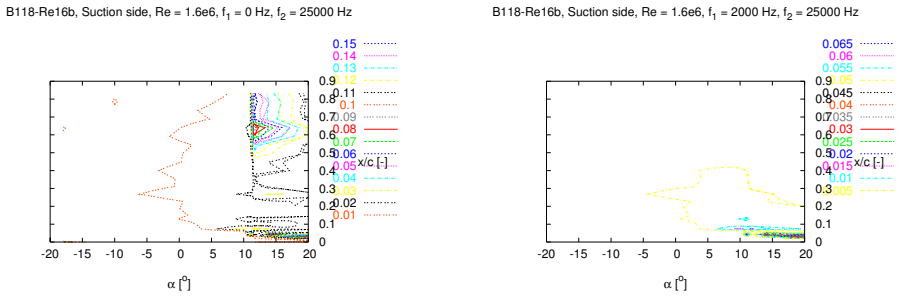

Figure 8: Contours of σ

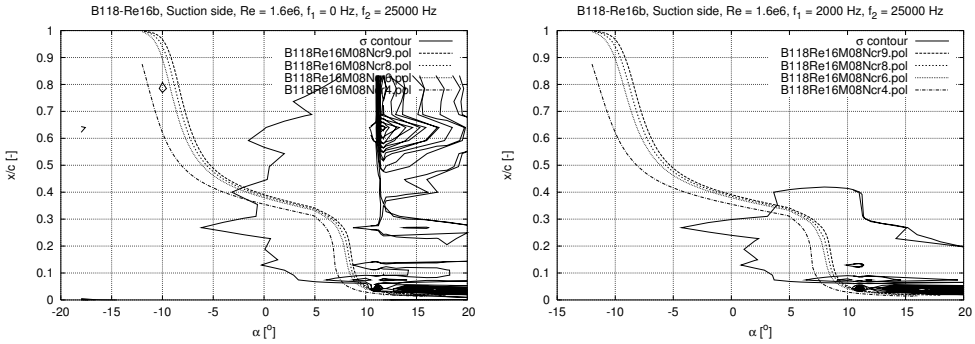

Figure 9: Contours of σ and XFoil data

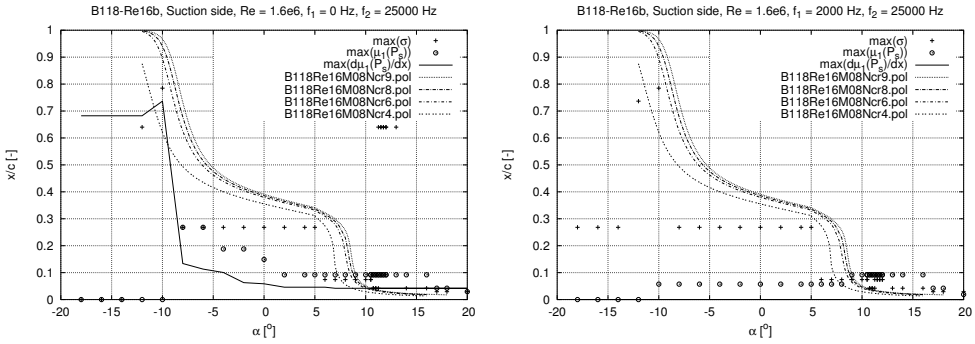

Figure 10: Transition detection

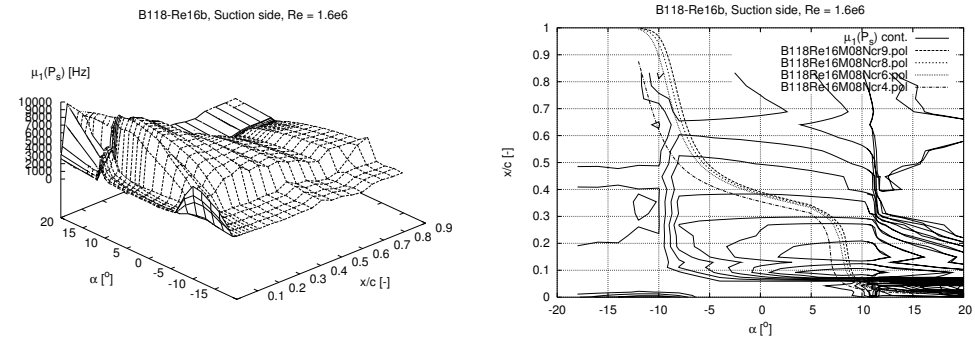

Figure 11: Fourier transform mean, $\mu_1(P_s)$

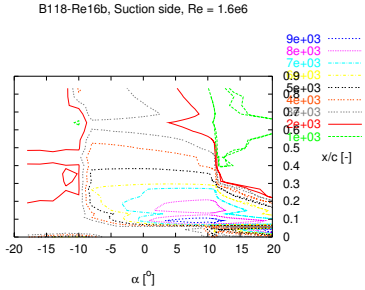

Figure 12: Contours of $\mu_1(P_s)$

```
B118-Re16b
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823      6159.0    3836.5
-16.00  0.6823      5814.9    5231.0
-14.00  0.6823      6888.4    5999.7
-12.00  0.6823      8115.5    6750.9
-10.00  0.7367     26263.0    6995.3
 -8.00  0.1339     26262.1    6045.2
 -6.00  0.1130     32587.5    6409.6
 -4.00  0.1005     38767.2    6870.9
 -2.00  0.0628     48916.4    7250.4
  0.00  0.0586     57322.7    7648.2
  2.00  0.0460     71694.3    8695.2
  4.00  0.0460     75664.9    9124.1
  5.00  0.0460     77809.7    9297.0
  6.00  0.0460     78773.4    9466.6
  7.00  0.0419     80698.8    9611.1
  8.00  0.0419     81134.5    9728.2
  9.00  0.0419     80321.9    9658.6
 10.00  0.0419     75031.7    9563.4
 10.50  0.0419     69925.2    9600.5
 10.75  0.0419     66278.8    9583.6
 11.00  0.0419     65295.0    9619.8
 11.25  0.0419     65204.7    9607.4
 11.50  0.0419     75151.0    9302.0
 11.75  0.0419     75875.2    9138.9
 12.00  0.0419     77095.7    9129.4
 13.00  0.0419     73122.0    8839.2
 14.00  0.0419     72063.6    8795.4
 16.00  0.0419     69520.1    8535.5
 17.00  0.0419     68442.4    8723.9
 18.00  0.0419     64603.6    8940.9
 20.00  0.0419     58453.3    9447.2
 12.00  0.0419     76786.4    9064.3
 11.75  0.0419     77524.8    9081.3
 11.50  0.0419     75553.2    9312.0
 11.25  0.0419     72531.8    9438.0
 11.00  0.0419     64475.4    9635.6
 10.75  0.0419     64918.5    9588.9
 10.50  0.0419     69128.3    9620.2
```

4.3 Re16c LM standard LER. ZZ 2% -

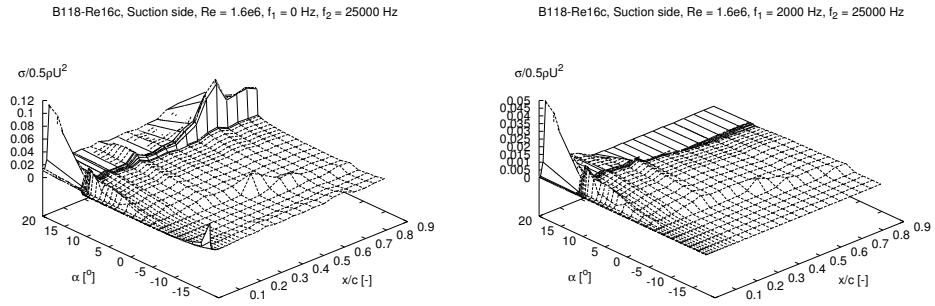

Figure 13: Pressure standard deviations, σ

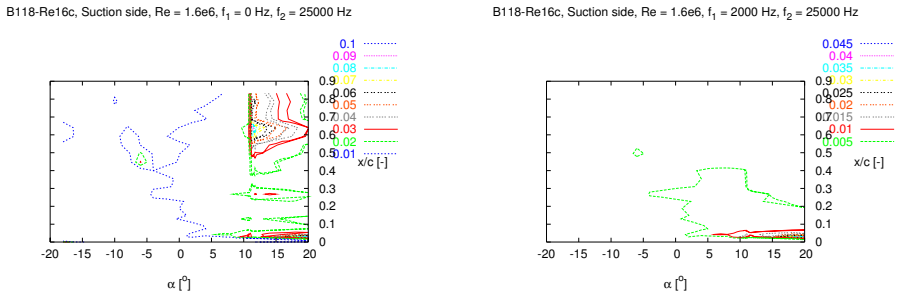

Figure 14: Contours of σ

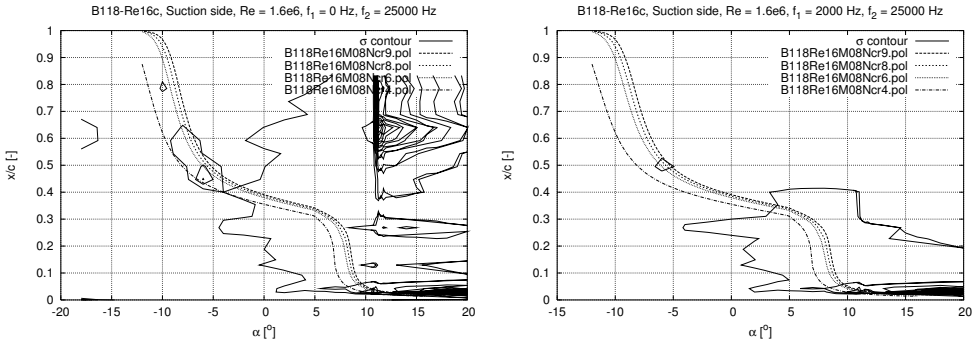

Figure 15: Contours of σ and XFoil data

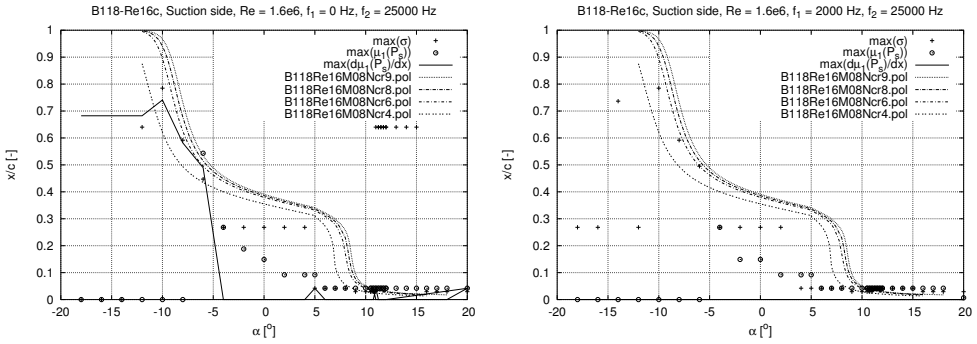

Figure 16: Transition detection

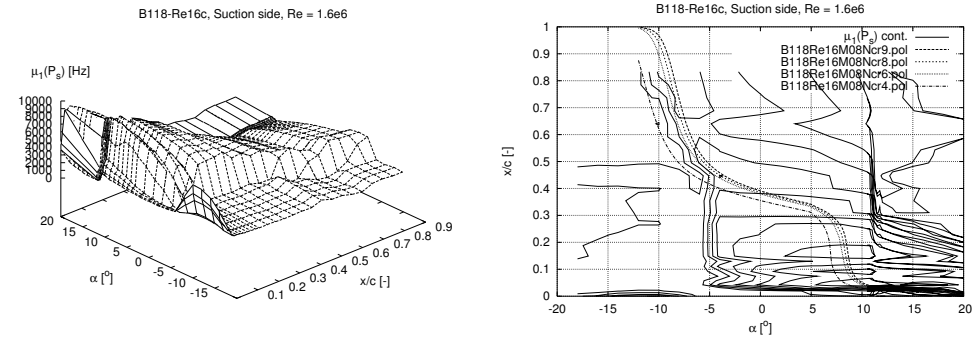

Figure 17: Fourier transform mean, $\mu_1(P_s)$

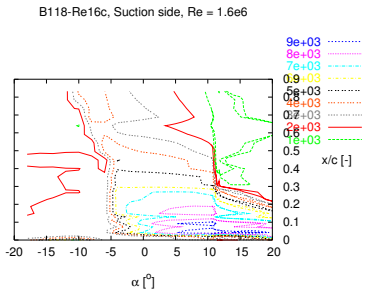

Figure 18: Contours of $\mu_1(P_s)$

```
B118-Re16c
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823      6634.8    3593.0
-16.00  0.6823      6221.7    5161.4
-14.00  0.6823      7593.1    6419.2
-12.00  0.6823      8335.2    6946.7
-10.00  0.7409     25911.0    7077.7
 -8.00  0.5818     21489.7    4973.9
 -6.00  0.4897     38790.3    4867.9
 -4.00  0.0000     42250.4    6806.3
 -2.00  0.0000     51387.4    7243.4
  0.00  0.0000     62585.7    7618.9
  2.00  0.0000     71771.0    8257.5
  4.00  0.0000     73963.1    8756.3
  5.00  0.0419     72331.0    8984.4
  6.00  0.0000     72463.3    9181.7
  7.00  0.0000     72429.1    9390.3
  8.00  0.0000     78489.2    9729.8
  9.00  0.0000     78650.7    9705.4
 10.00  0.0000     76173.2    9889.1
 10.50  0.0000     75050.6    9917.6
 10.75  0.0000     73635.9    9896.8
 11.00  0.0419     70580.9    9617.7
 11.25  0.0000     82746.6    9534.8
 11.50  0.0000     83969.1    9527.1
 11.75  0.0000     83559.4    9533.5
 12.00  0.0000     83823.8    9412.3
 13.00  0.0000     82318.9    8975.5
 14.00  0.0000     80059.9    9006.6
 15.00  0.0000     79408.2    9254.4
 16.00  0.0000     72556.6    9383.4
 17.00  0.0000     68935.0    9383.0
 18.00  0.0000     65342.2    9283.1
 20.00  0.0419     46446.2    8905.3
 12.00  0.0000     84519.8    9386.3
 11.75  0.0000     85985.7    9398.9
 11.50  0.0000     84129.1    9552.5
 11.25  0.0000     82993.0    9649.4
 11.00  0.0000     80514.4    9720.5
 10.75  0.0419     70875.9    9744.8
 10.50  0.0419     71600.9    9924.2
```

4.4 Re16d Trip wire. Bump tape 2% -

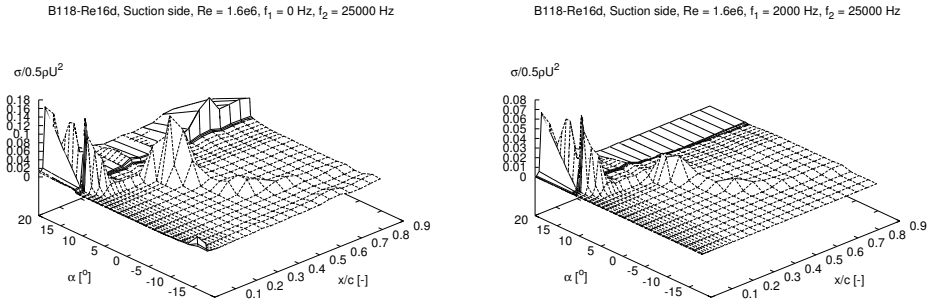

Figure 19: Pressure standard deviations, σ

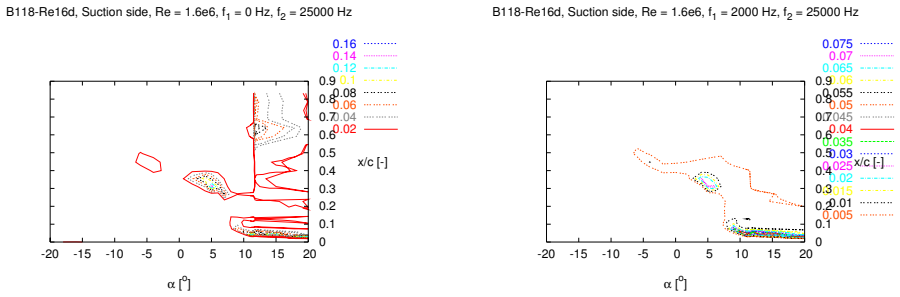

Figure 20: Contours of σ

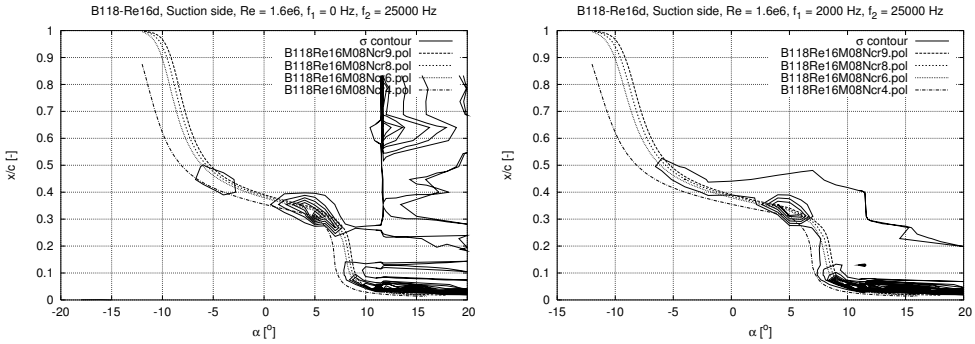

Figure 21: Contours of σ and XFoil data

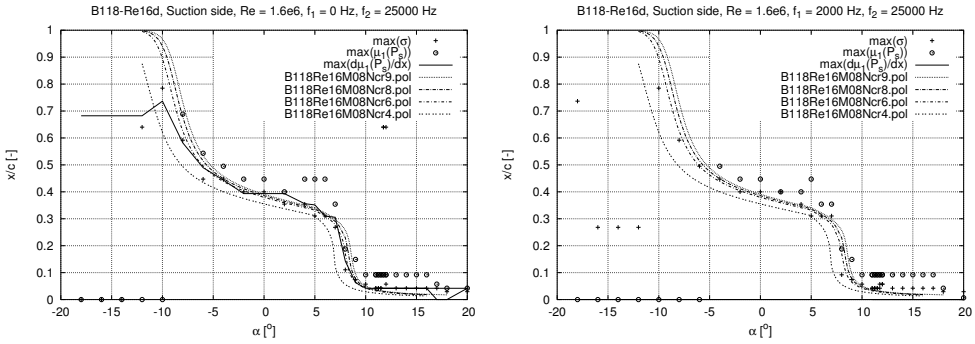

Figure 22: Transition detection

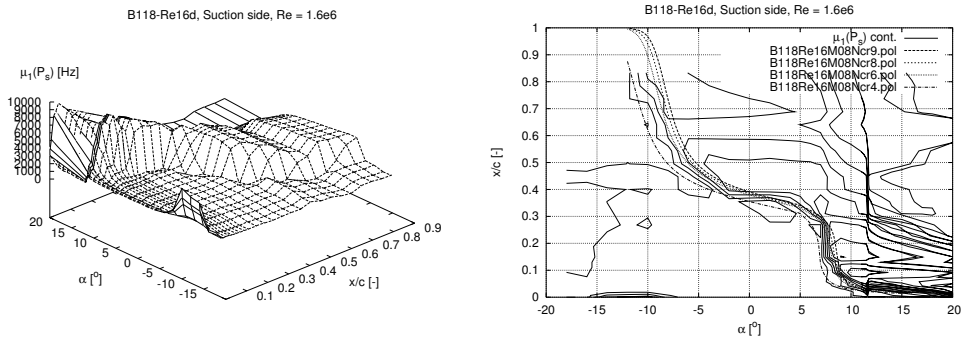

Figure 23: Fourier transform mean, $\mu_1(P_s)$

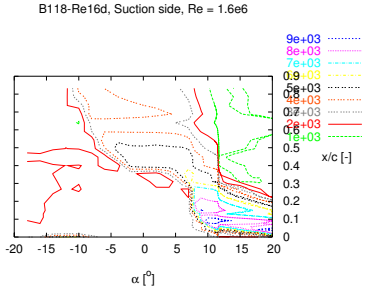

Figure 24: Contours of $\mu_1(P_s)$

```
B118-Re16d
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823      5375.3    3025.8
-16.00  0.6823      5689.7    2965.6
-14.00  0.6823      7679.1    5889.5
-12.00  0.6823      8435.5    6119.1
-10.00  0.7367     26454.2    6725.2
 -8.00  0.5818     21222.3    4746.8
 -6.00  0.4897     38536.9    4850.3
 -4.00  0.4437     43762.8    5340.2
 -2.00  0.3935     39035.4    5706.9
  0.00  0.3935     45634.3    5825.1
  2.00  0.3935     48728.1    5901.4
  4.00  0.3558     46304.7    5777.7
  5.00  0.3516     37398.6    5783.1
  6.00  0.3098     42096.4    5776.0
  7.00  0.3056     52708.9    6560.7
  8.00  0.1423     54753.6    8041.6
  9.00  0.0628     64427.7    9044.1
 10.00  0.0419     82576.8    9851.2
 11.00  0.0419     80288.7    9716.1
 11.25  0.0419     78890.1    9683.9
 11.50  0.0419     77713.7    9651.1
 11.75  0.0419     84105.0    9392.0
 12.00  0.0419     84508.2    9311.6
 13.00  0.0419     80383.2    8992.3
 14.00  0.0419     78222.9    8813.3
 15.00  0.0419     76190.4    8731.3
 16.00  0.0419     75225.3    8637.8
 17.00  0.0000     76208.4    8602.4
 18.00  0.0000     72433.7    9050.4
 20.00  0.0419     56004.5    9351.7
 12.00  0.0419     82780.3    9256.7
 11.75  0.0419     83098.3    9312.0
 11.50  0.0419     77854.1    9695.7
 11.25  0.0419     78822.6    9697.9
 11.00  0.0419     80205.4    9718.6
```

4.5 Re16e Clean -

Figure 25: Pressure standard deviations, σ

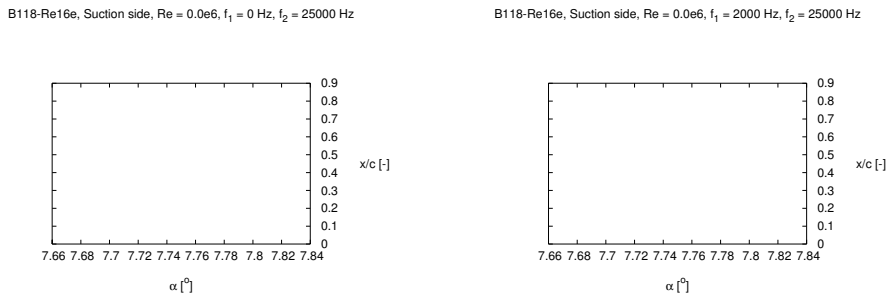

Figure 26: Contours of σ

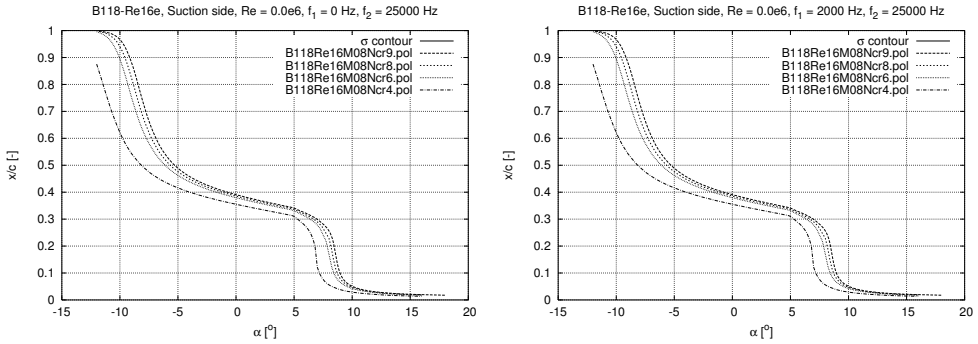

Figure 27: Contours of σ and XFoil data

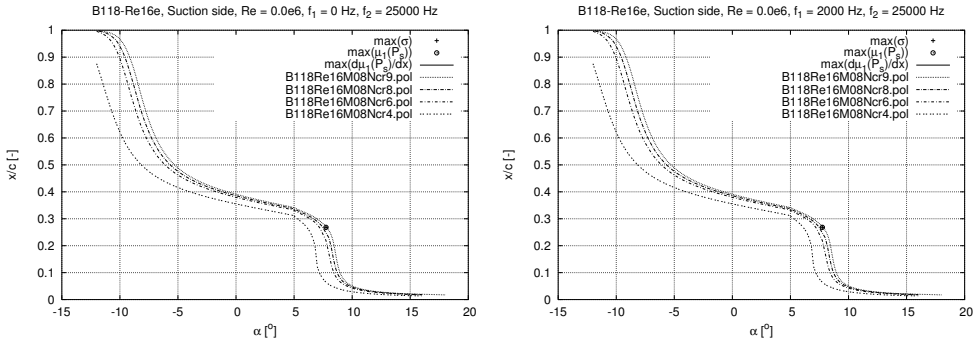

Figure 28: Transition detection

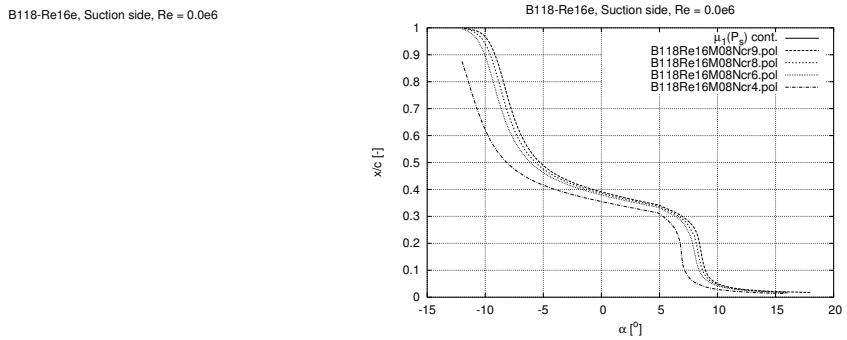

Figure 29: Fourier transform mean, $\mu_1(P_s)$

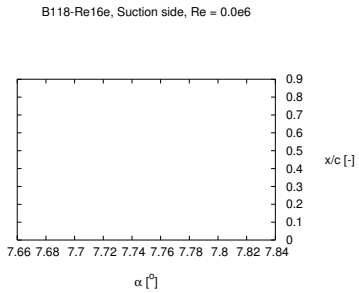

Figure 30: Contours of $\mu_1(P_s)$

```
B118-Re16e
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
  7.75  0.2218     54078.6    7020.5
```

4.6 Re16f Clean 200x200

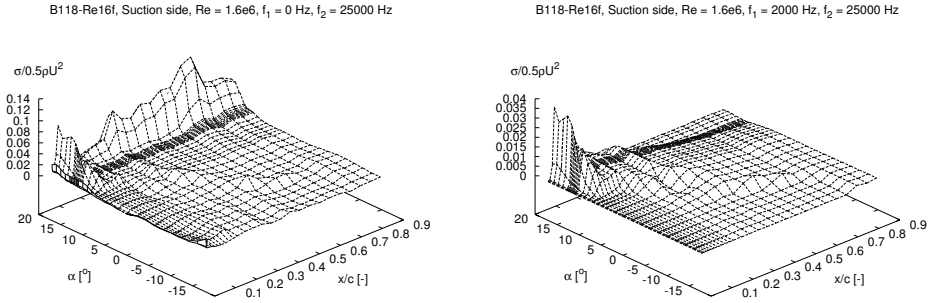

Figure 31: Pressure standard deviations, σ

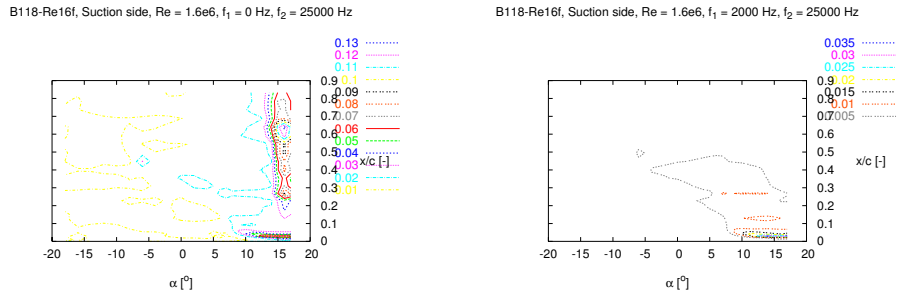

Figure 32: Contours of σ

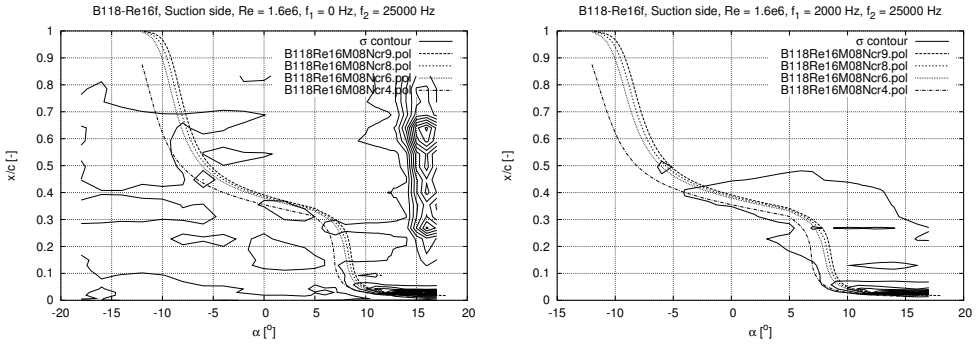

Figure 33: Contours of σ and XFoil data

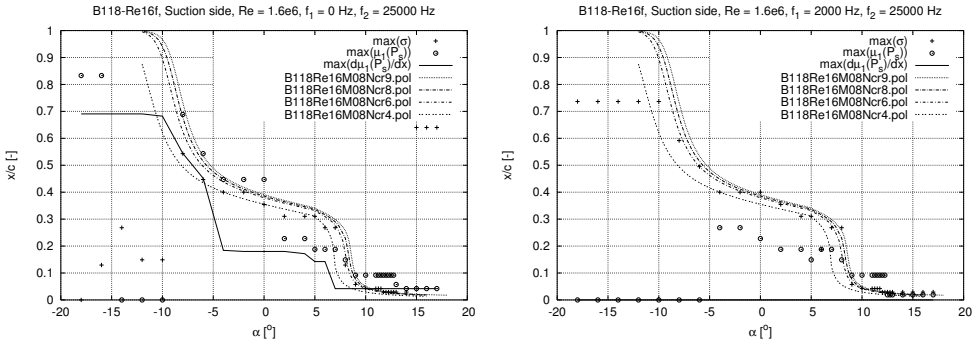

Figure 34: Transition detection

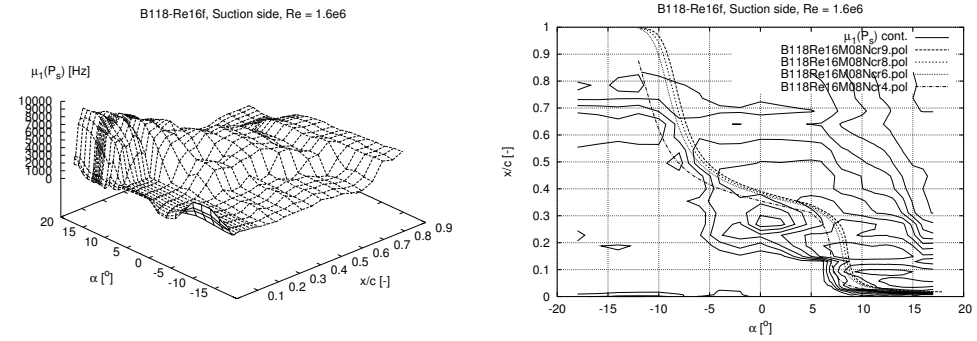

Figure 35: Fourier transform mean, $\mu_1(P_s)$

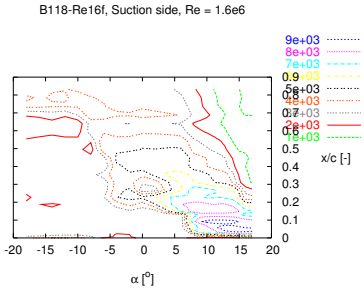

Figure 36: Contours of $\mu_1(P_s)$

```
B118-Re16f
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     30162.8    4424.3
-16.00  0.6907     29176.5    4300.6
-14.00  0.6907     25548.6    5062.1
-12.00  0.6907     27232.6    5047.3
-10.00  0.6823     30365.7    4859.4
 -8.00  0.5442     21259.2    4668.5
 -6.00  0.4521     29645.6    4847.9
 -4.00  0.1842     29491.8    5268.2
 -2.00  0.1800     31304.3    5472.4
  0.00  0.1800     31797.8    5774.9
  2.00  0.1800     39266.7    5960.9
  4.00  0.1716     49780.5    6841.1
  5.00  0.1423     56458.7    7328.4
  6.00  0.1423     63215.4    7941.2
  7.00  0.0419     40218.1    8192.0
  8.00  0.0419     65535.1    8579.2
  9.00  0.0419     74382.2    8851.5
 10.00  0.0419     87907.1    9265.1
 11.00  0.0419     87153.3    9400.3
 11.25  0.0419     88266.1    9355.0
 11.50  0.0419     86769.0    9380.0
 11.75  0.0419     86636.8    9358.7
 12.00  0.0419     87099.8    9372.6
 12.25  0.0419     87496.3    9337.2
 12.50  0.0419     88676.4    9366.4
 12.75  0.0419     88685.7    9348.2
 13.00  0.0419     88167.9    9370.2
 14.00  0.0419     87019.2    9652.2
 15.00  0.0419     79790.4    9542.7
 16.00  0.0419     65677.4    9464.4
 17.00  0.0419     66112.3    9472.3
```

4.7 Re16fII Clean 200x200

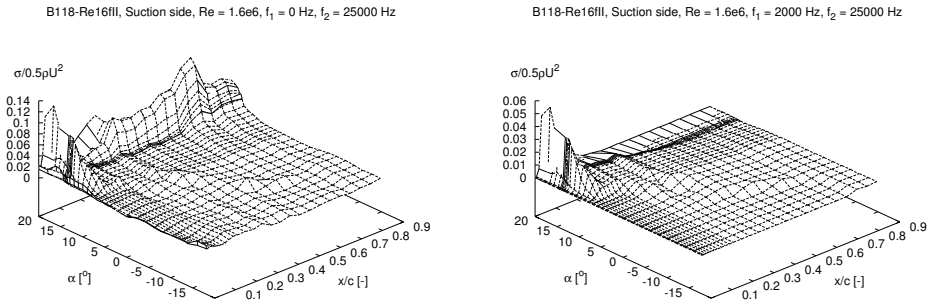

Figure 37: Pressure standard deviations, σ

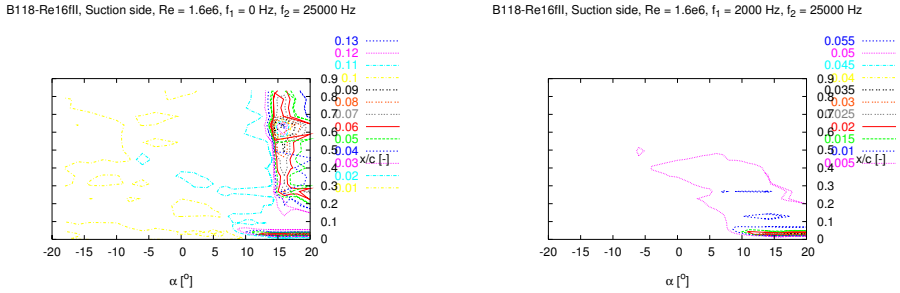

Figure 38: Contours of σ

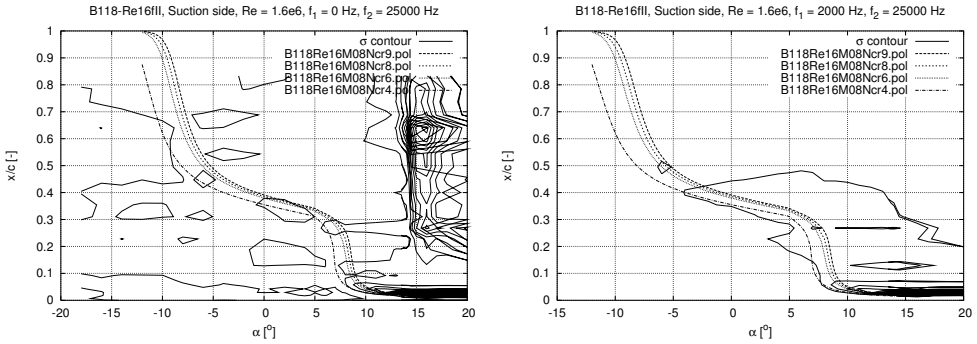

Figure 39: Contours of σ and XFoil data

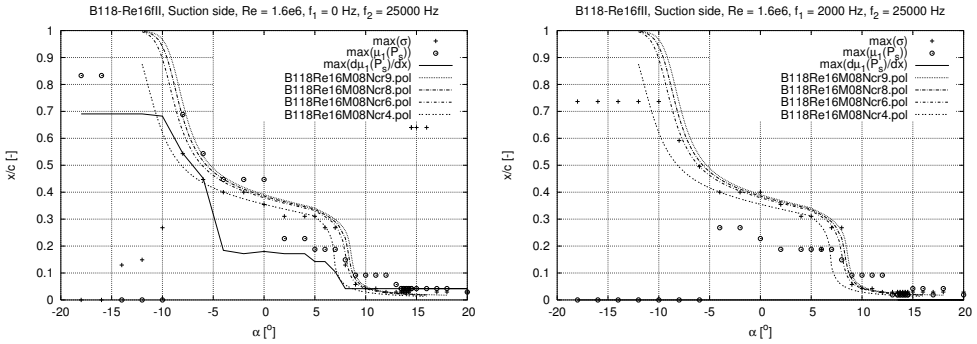

Figure 40: Transition detection

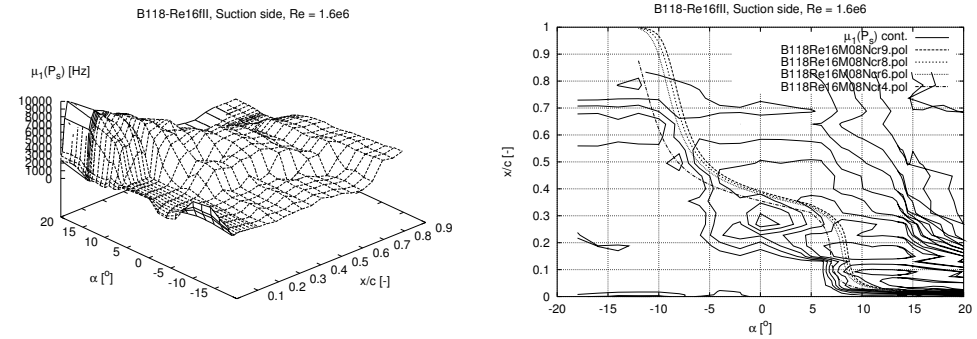

Figure 41: Fourier transform mean, $\mu_1(P_s)$

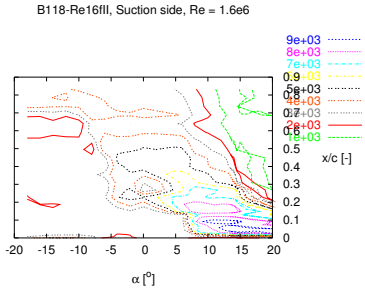

Figure 42: Contours of $\mu_1(P_s)$

```
B118-Re16fII
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     30820.7    4444.0
-16.00  0.6907     30663.1    4381.3
-14.00  0.6907     25409.3    5268.2
-12.00  0.6907     27308.4    5080.5
-10.00  0.6823     30413.2    4945.1
 -8.00  0.5442     21380.0    4666.6
 -6.00  0.4521     28428.0    4851.3
 -4.00  0.1842     28725.4    5242.5
 -2.00  0.1716     30386.9    5446.3
  0.00  0.1800     30161.5    5748.5
  2.00  0.1716     37117.8    5886.9
  4.00  0.1716     49204.8    6789.3
  5.00  0.1423     56067.3    7320.3
  6.00  0.1423     62174.5    7926.2
  7.00  0.1046     41069.8    8217.9
  8.00  0.0419     65692.4    8590.6
  9.00  0.0419     75452.9    8857.1
 10.00  0.0419     86269.1    9283.0
 11.00  0.0419     88900.6    9417.0
 12.00  0.0419     86795.9    9352.4
 13.00  0.0419     87932.3    9365.6
 13.50  0.0419     88747.2    9435.5
 13.75  0.0419     89337.1    9603.5
 14.00  0.0419     88673.9    9702.0
 14.25  0.0419     87161.9    9728.5
 14.50  0.0419     83718.8    9730.7
 15.00  0.0419     79555.8    9581.1
 16.00  0.0419     72224.4    9530.7
 17.00  0.0419     66265.2    9436.9
 18.00  0.0419     64928.7    9463.9
 20.00  0.0419     63765.5    9715.3
 14.50  0.0419     87262.2    9886.6
 14.25  0.0419     87924.1    9828.4
 14.00  0.0419     87784.8    9714.2
 13.75  0.0419     87957.7    9615.5
 13.50  0.0419     88630.9    9503.3
```

4.8 Re16g ZZ90 x/c=5% suc. x/c=10% press. 200x200

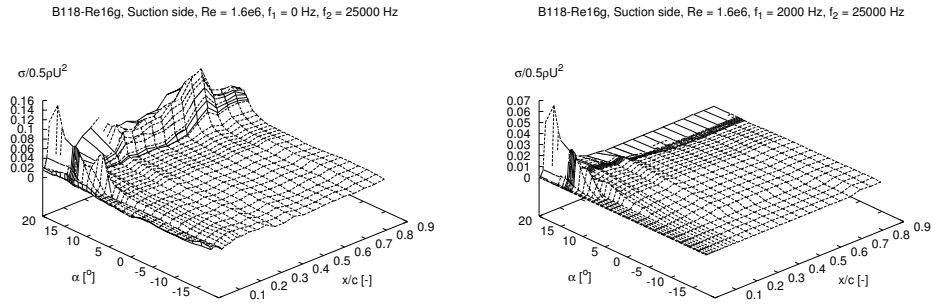

Figure 43: Pressure standard deviations, σ

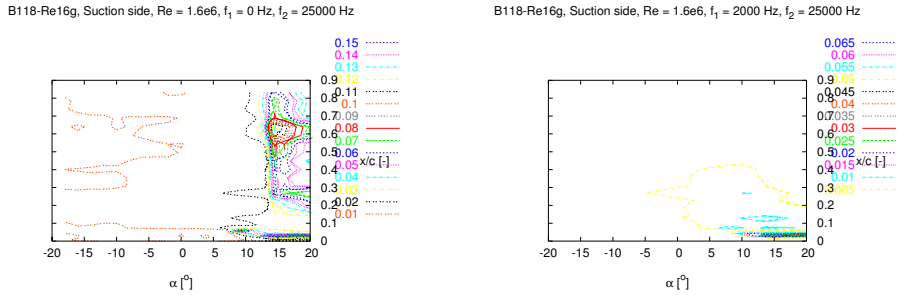

Figure 44: Contours of σ

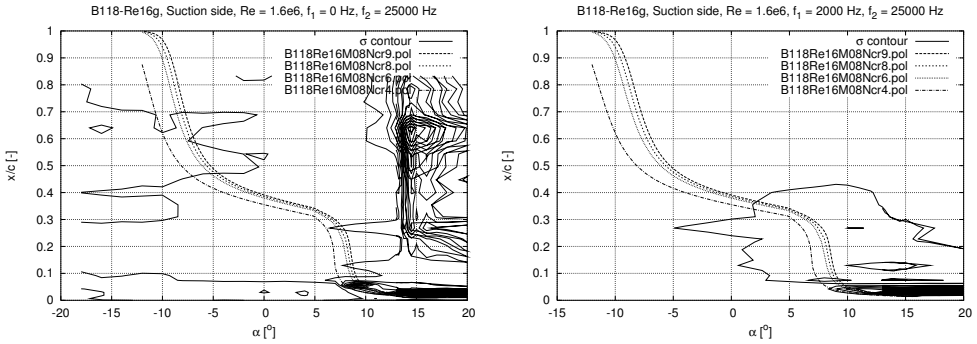

Figure 45: Contours of σ and XFoil data

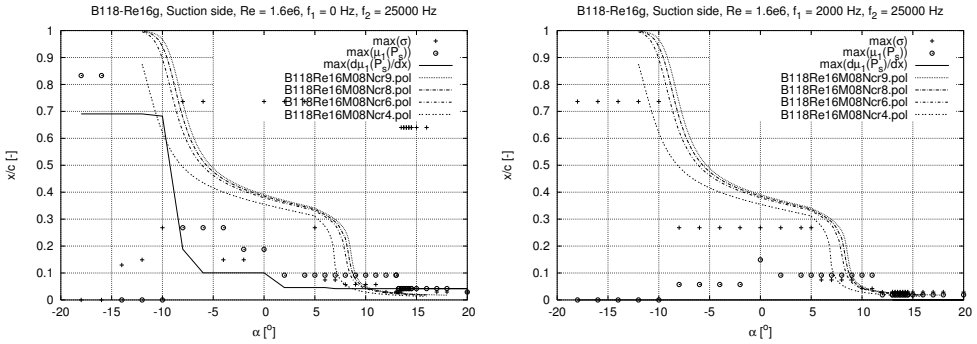

Figure 46: Transition detection

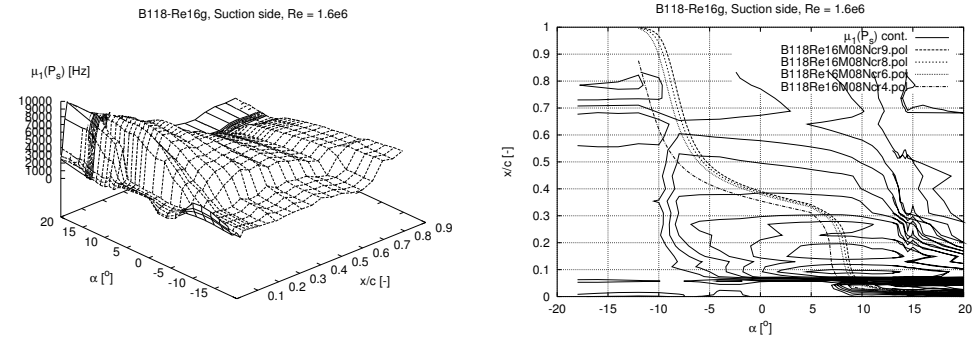

Figure 47: Fourier transform mean, $\mu_1(P_s)$

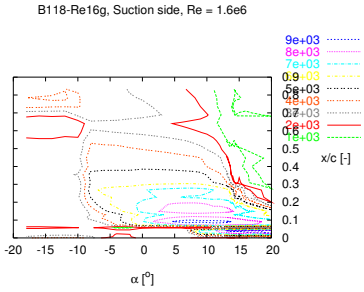

Figure 48: Contours of $\mu_1(P_s)$

```
B118-Re16g
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     29988.1    4494.5
-16.00  0.6907     31040.8    4389.6
-14.00  0.6907     28841.1    4689.4
-12.00  0.6907     27497.2    4841.2
-10.00  0.6823     29920.3    4748.8
 -8.00  0.1884     21631.6    5635.4
 -6.00  0.1005     31003.4    6259.7
 -4.00  0.1005     50547.0    6505.3
 -2.00  0.1005     58207.4    6655.6
  0.00  0.1005     56205.0    7319.4
  2.00  0.0460     61950.1    8202.0
  4.00  0.0460     70571.5    8875.9
  5.00  0.0460     73079.9    9100.2
  6.00  0.0460     74925.7    9245.5
  7.00  0.0419     78455.9    9372.2
  8.00  0.0419     83755.2    9313.2
  9.00  0.0419     80850.2    9208.1
 10.00  0.0419     85097.1    9218.0
 11.00  0.0419     86798.6    9236.3
 12.00  0.0419     84660.1    9182.5
 13.00  0.0419     82222.0    9120.6
 13.25  0.0419     84026.1    9210.1
 13.50  0.0419     82672.5    9332.3
 13.75  0.0419     80329.5    9301.5
 14.00  0.0419     80061.9    9403.8
 14.25  0.0419     77320.9    9340.6
 14.50  0.0419     73031.6    9274.3
 15.00  0.0419     71721.5    9376.9
 16.00  0.0419     62135.9    9212.5
 17.00  0.0419     64076.6    9237.5
 18.00  0.0419     61435.3    9250.3
 20.00  0.0419     59597.8    9618.8
 14.50  0.0419     78961.2    9303.5
 14.25  0.0419     79298.1    9405.4
 14.00  0.0419     82643.7    9456.3
 13.75  0.0419     81643.2    9461.8
 13.50  0.0419     83979.9    9350.4
 13.25  0.0419     81765.0    9242.9
 13.00  0.0419     83051.2    9106.1
```

4.9 Re16h LER. ZZ 2% 200x200

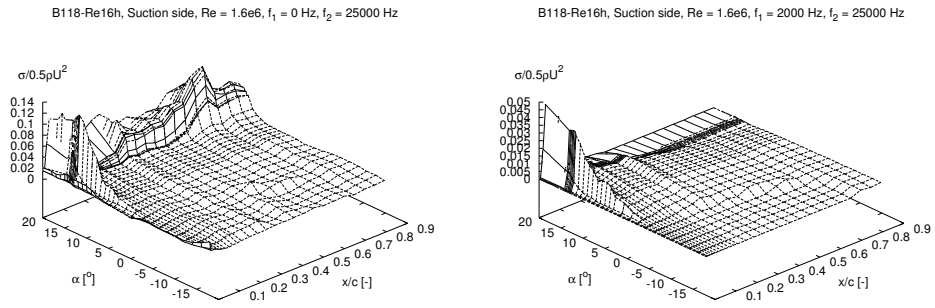

Figure 49: Pressure standard deviations, σ

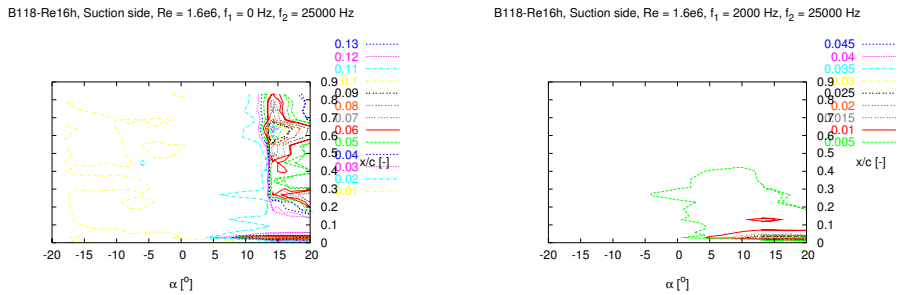

Figure 50: Contours of σ

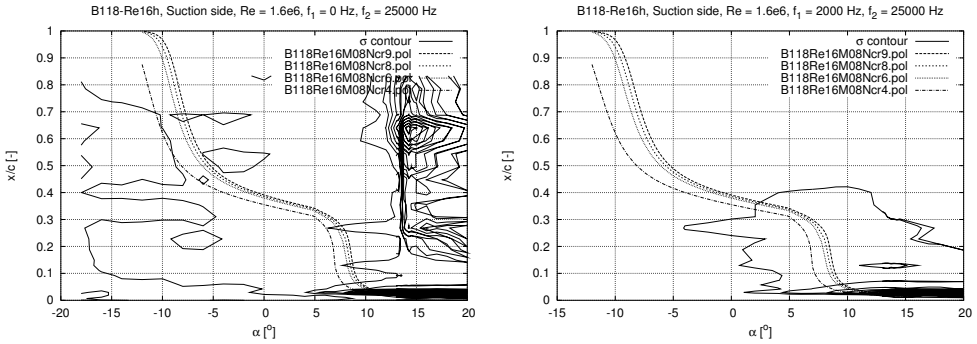

Figure 51: Contours of σ and XFoil data

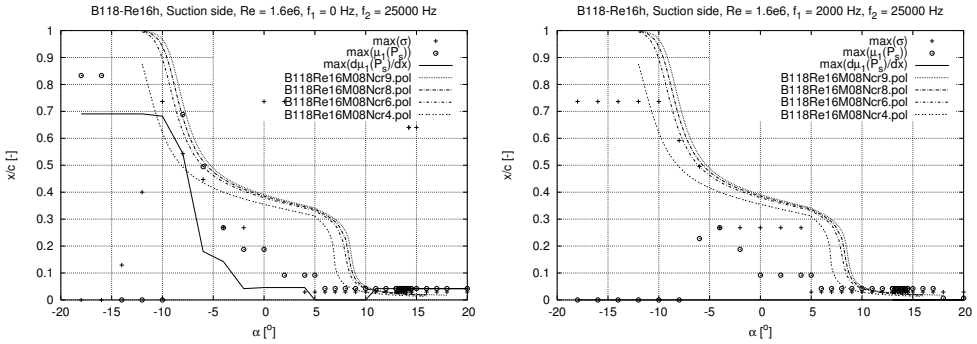

Figure 52: Transition detection

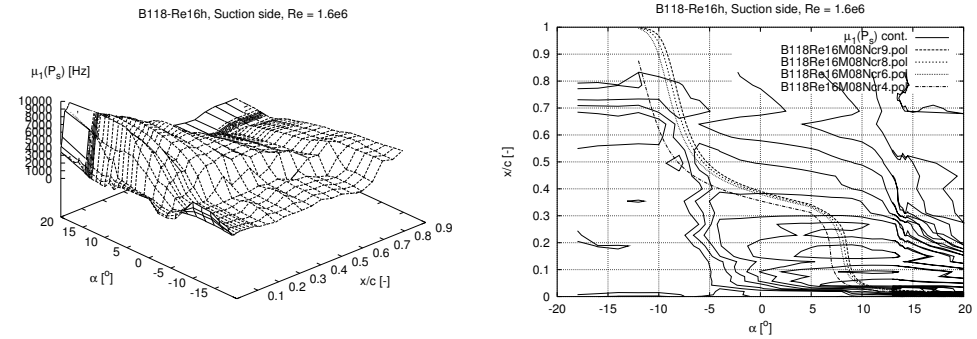

Figure 53: Fourier transform mean, $\mu_1(P_s)$

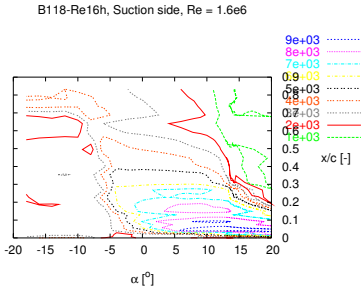

Figure 54: Contours of $\mu_1(P_s)$

```
B118-Re16h
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     30913.6    4510.4
-16.00  0.6907     30640.9    4359.3
-14.00  0.6907     28543.2    4698.9
-12.00  0.6907     28040.0    4730.3
-10.00  0.6823     30517.7    4878.2
 -8.00  0.5442     22833.2    4678.3
 -6.00  0.1800     25702.2    4760.2
 -4.00  0.1423     28503.8    6438.8
 -2.00  0.0419     45185.6    6804.0
  0.00  0.0460     50420.3    7331.0
  2.00  0.0460     60911.5    7975.9
  4.00  0.0460     67477.0    8557.2
  5.00  0.0000     72667.5    8746.6
  6.00  0.0000     82841.3    9107.0
  7.00  0.0000     86522.9    9444.0
  8.00  0.0000     92175.3    9609.4
  9.00  0.0000     79290.3    9617.2
 10.00  0.0000     84171.3    9664.3
 11.00  0.0419     84880.0    9688.1
 12.00  0.0419     82885.6    9684.3
 13.00  0.0419     82577.9    9717.1
 13.25  0.0419     79957.5    9715.4
 13.50  0.0419     81303.8    9724.7
 13.75  0.0419     79166.6    9631.8
 14.00  0.0419     77513.1    9710.1
 14.25  0.0419     76078.6    9660.1
 14.50  0.0419     76069.8    9662.0
 15.00  0.0419     68820.4    9552.0
 16.00  0.0419     59273.3    9377.8
 17.00  0.0419     61321.1    9329.8
 18.00  0.0419     57323.4    9346.6
 20.00  0.0419     49245.9    9371.2
 14.50  0.0419     74491.4    9652.2
 14.25  0.0419     76237.7    9679.6
 14.00  0.0419     78156.7    9676.0
 13.75  0.0419     77310.0    9686.1
 13.50  0.0419     81098.2    9762.6
 13.25  0.0419     81373.5    9707.8
 13.00  0.0419     79815.9    9740.3
```

4.10 Re16i Trip wire. Bump tape 0,1 2% 200x200

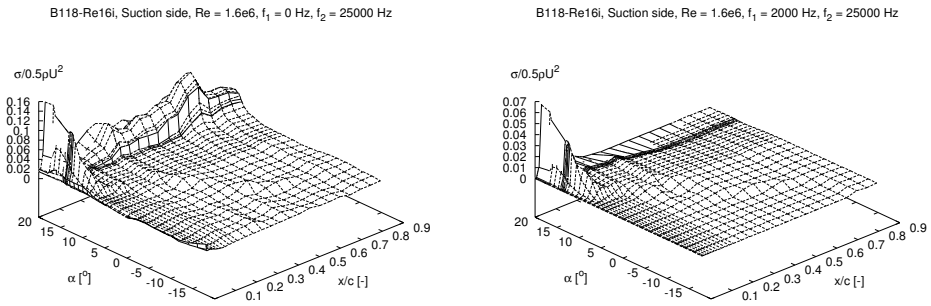

Figure 55: Pressure standard deviations, σ

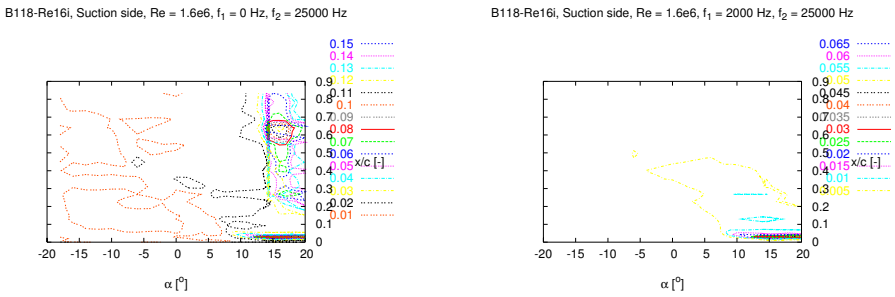

Figure 56: Contours of σ

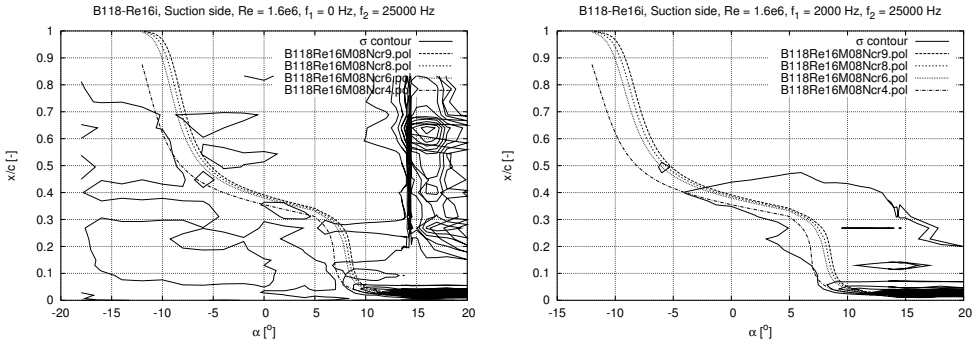

Figure 57: Contours of σ and XFoil data

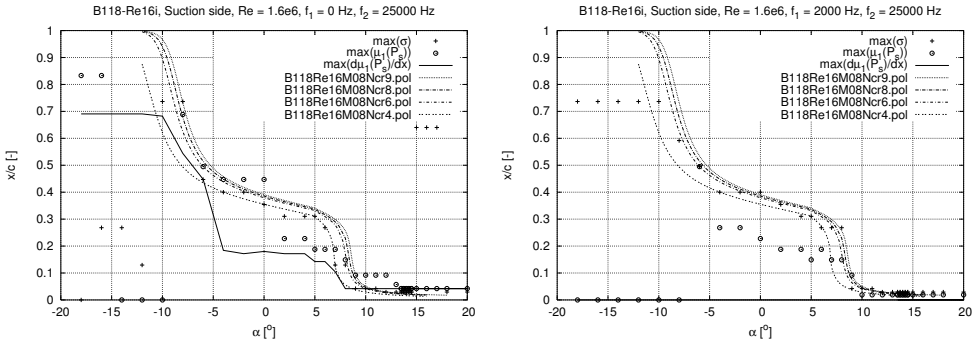

Figure 58: Transition detection

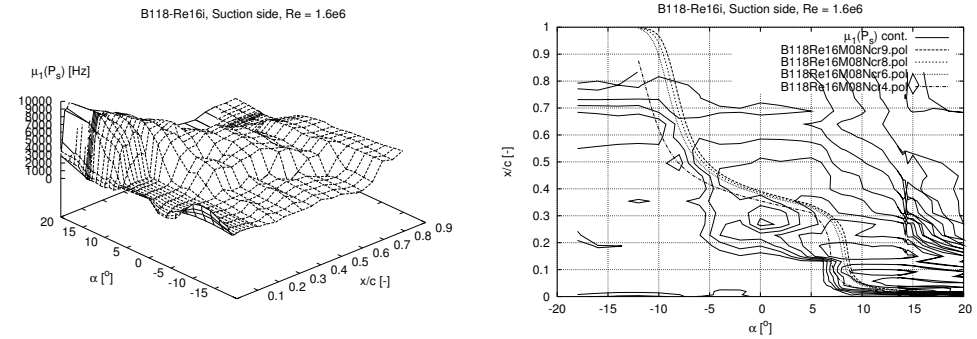

Figure 59: Fourier transform mean, $\mu_1(P_s)$

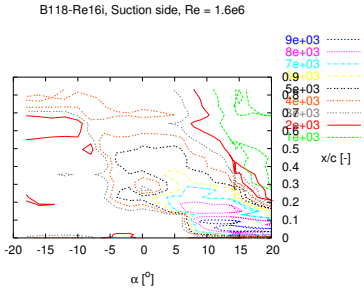

Figure 60: Contours of $\mu_1(P_s)$

```
B118-Re16i
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     30501.1    4498.5
-16.00  0.6907     29802.4    4327.6
-14.00  0.6907     28377.9    4823.8
-12.00  0.6907     27856.1    4897.9
-10.00  0.6823     30902.8    4642.4
 -8.00  0.5442     22447.5    4679.1
 -6.00  0.4479     31120.8    4902.8
 -4.00  0.1842     29974.8    5293.9
 -2.00  0.1716     32475.4    5503.6
  0.00  0.1800     35046.2    5805.3
  2.00  0.1716     40297.5    6161.7
  4.00  0.1716     52111.7    7104.4
  5.00  0.1423     58884.8    7590.2
  6.00  0.1423     64268.3    8102.9
  7.00  0.1046     41443.2    8334.1
  8.00  0.0419     70714.5    8737.6
  9.00  0.0419     82161.5    9206.8
 10.00  0.0419     87948.8    9362.6
 11.00  0.0419     89588.7    9429.1
 12.00  0.0419     87752.9    9392.9
 13.00  0.0419     87844.0    9394.3
 13.50  0.0419     87625.7    9530.0
 13.75  0.0419     86080.7    9636.8
 14.00  0.0419     88075.6    9673.7
 14.25  0.0419     86821.6    9667.5
 14.50  0.0419     83939.8    9640.8
 15.00  0.0419     80664.6    9640.6
 16.00  0.0419     69137.4    9388.9
 17.00  0.0419     66025.5    9277.1
 18.00  0.0419     62948.6    9301.8
 20.00  0.0419     57938.4    9388.6
 14.50  0.0419     84096.7    9727.0
 14.25  0.0419     85429.1    9681.1
 14.00  0.0419     85743.2    9683.3
 13.75  0.0419     87974.8    9645.5
 13.50  0.0419     87062.9    9559.7
```

4.11 Re16j Clean 100x100

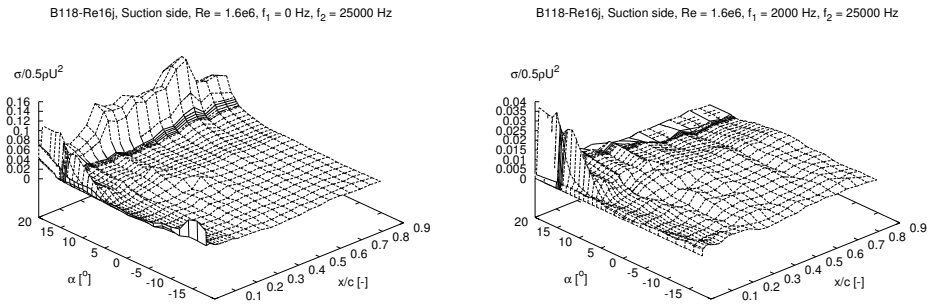

Figure 61: Pressure standard deviations, σ

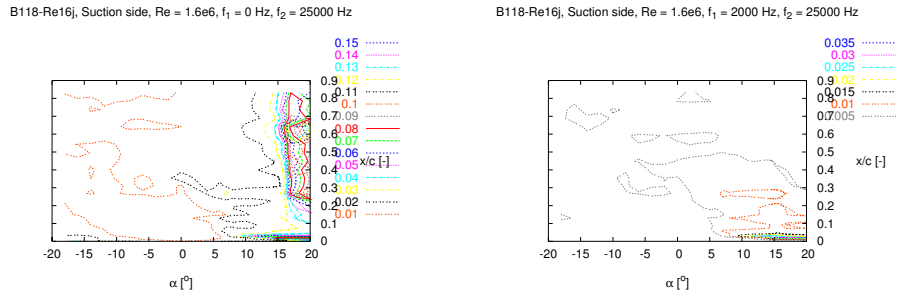

Figure 62: Contours of σ

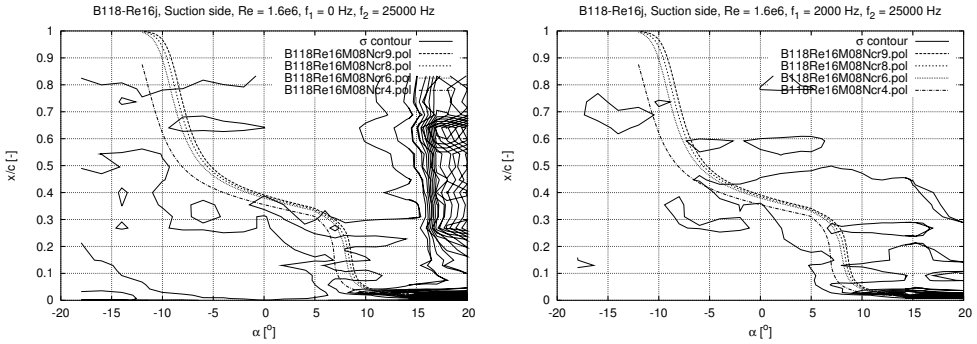

Figure 63: Contours of σ and XFoil data

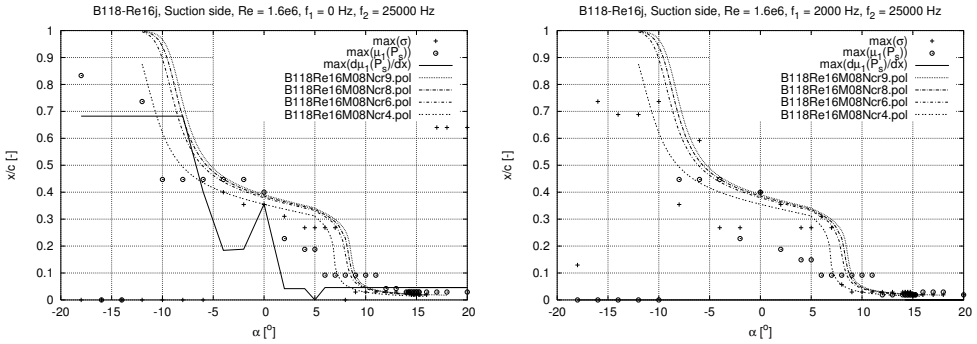

Figure 64: Transition detection

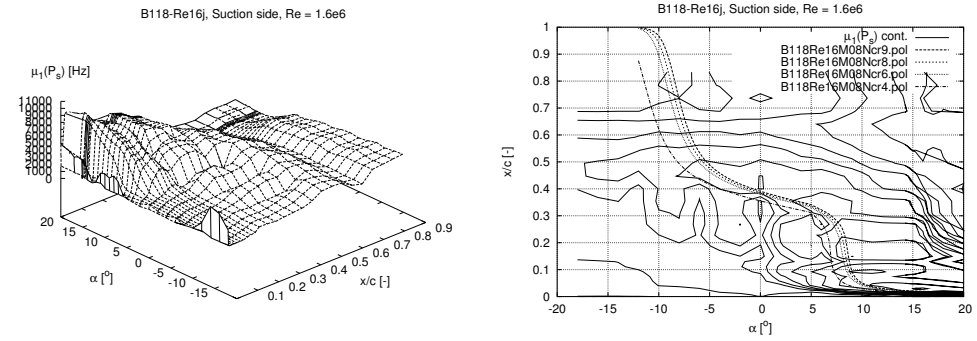

Figure 65: Fourier transform mean, $\mu_1(P_s)$

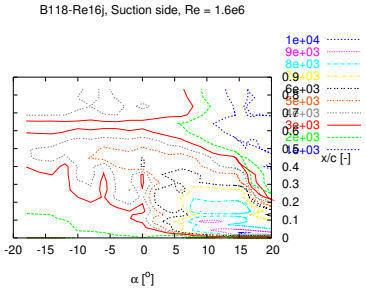

Figure 66: Contours of $\mu_1(P_s)$

```
B118-Re16j
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823     18108.0    4475.1
-16.00  0.6823     17272.8    5432.2
-14.00  0.6823     18688.2    5890.0
-12.00  0.6823     20161.5    4549.0
-10.00  0.6823     16093.9    4792.7
 -8.00  0.6823     15535.8    5032.6
 -6.00  0.4018     27149.2    5377.3
 -4.00  0.1842     19803.2    5665.4
 -2.00  0.1884     21422.1    5590.6
  0.00  0.3558     36396.9    6059.4
  2.00  0.0419     46586.1    6174.8
  4.00  0.0419     55865.2    6636.2
  5.00  0.0000     61205.2    7000.7
  6.00  0.0460     65748.9    7399.9
  7.00  0.0460     72352.7    7955.5
  8.00  0.0460     80768.0    8723.5
  9.00  0.0460     85266.0    9088.8
 10.00  0.0460     84429.4    9205.4
 11.00  0.0460     78890.6    9259.7
 12.00  0.0460     79917.3    9379.7
 13.00  0.0460     79520.0    9555.2
 14.00  0.0460     73805.6    9571.1
 14.25  0.0460     71782.8    9681.4
 14.50  0.0460     70687.2    9770.0
 14.75  0.0460     68913.6    9862.5
 15.00  0.0460     68861.9    9966.9
 15.25  0.0460     65794.8   10086.0
 16.00  0.0460     63826.9   10221.5
 17.00  0.0460     63832.2    9762.3
 18.00  0.0460     58012.7    9548.2
 20.00  0.0460     48827.2    9199.8
 15.25  0.0460     66552.3   10097.0
 15.00  0.0460     67476.7   10002.5
 14.75  0.0460     68661.2    9890.1
 14.50  0.0460     70442.9    9781.1
 14.25  0.0460     71807.6    9685.4
```

4.12 Re16k ZZ90 x/c=5% suc. x/c=10% press.

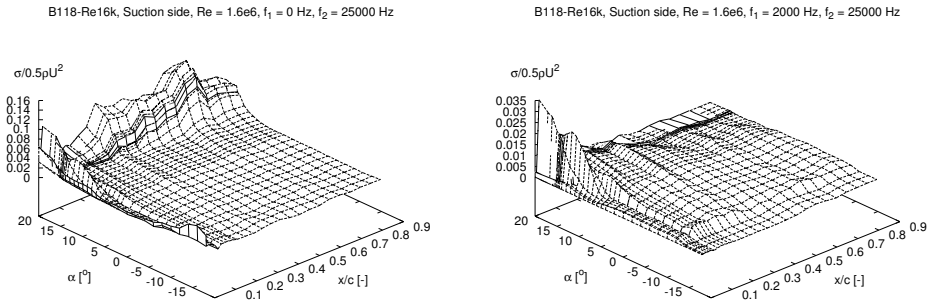

Figure 67: Pressure standard deviations, σ

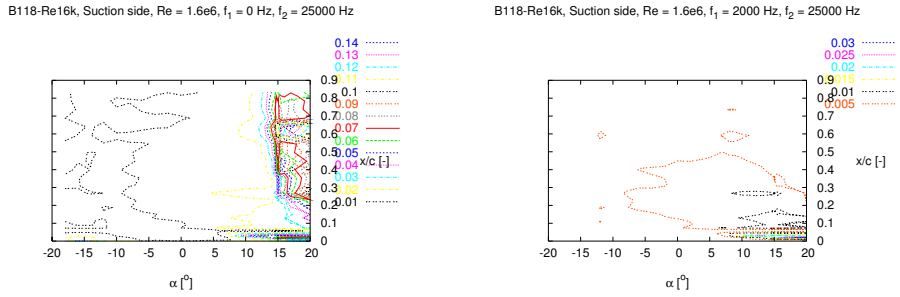

Figure 68: Contours of σ

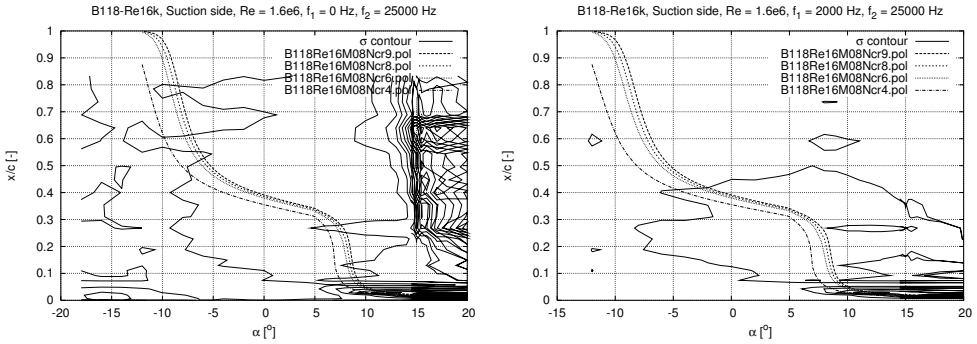

Figure 69: Contours of σ and XFoil data

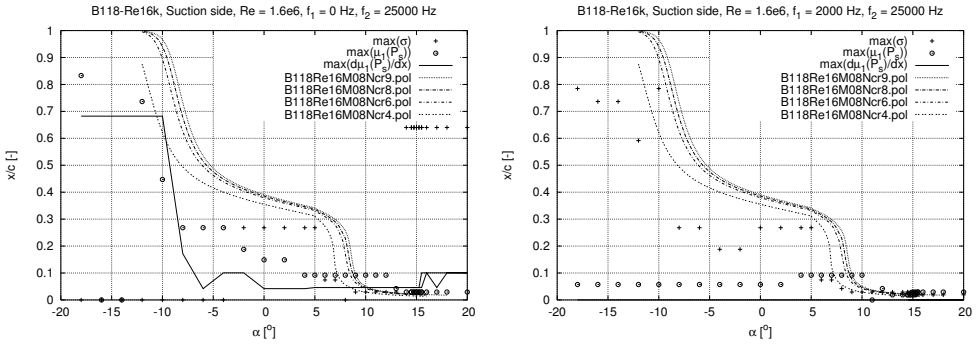

Figure 70: Transition detection

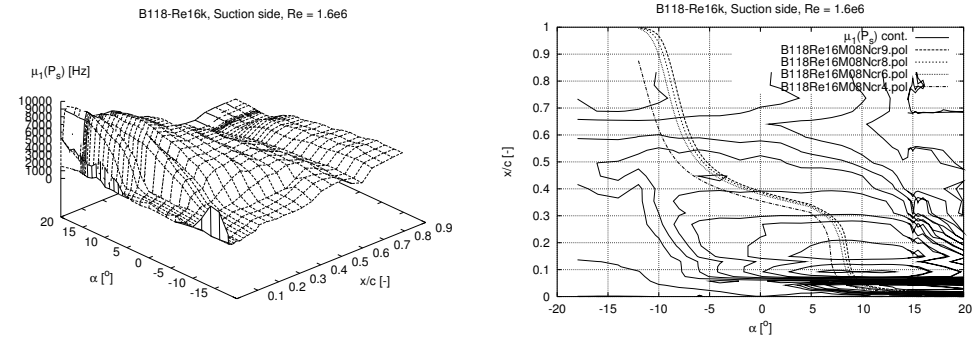

Figure 71: Fourier transform mean, $\mu_1(P_s)$

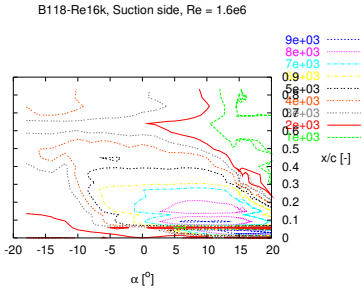

Figure 72: Contours of $\mu_1(P_s)$

```
B118-Re16k
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823     16911.6    4273.5
-16.00  0.6823     17760.1    5133.9
-14.00  0.6823     18122.1    5436.5
-12.00  0.6823     19780.1    4484.0
-10.00  0.6823     16290.1    4792.7
 -8.00  0.1716     20889.0    5445.3
 -6.00  0.0419     30166.2    6341.9
 -4.00  0.1005     47420.6    6671.0
 -2.00  0.1005     48949.3    6828.0
  0.00  0.0419     59456.2    7481.5
  2.00  0.0419     70280.1    7891.4
  4.00  0.0419     78314.2    8456.2
  5.00  0.0460     82426.8    8821.9
  6.00  0.0460     85343.8    9062.1
  7.00  0.0460     87011.1    9205.4
  8.00  0.0460     85320.2    9169.3
  9.00  0.0460     82661.1    9041.7
 10.00  0.0460     81560.6    8998.3
 11.00  0.0460     75608.4    9102.8
 12.00  0.0460     74609.8    9149.3
 13.00  0.0460     78090.8    9140.8
 14.00  0.0460     75585.1    9244.5
 14.50  0.0460     74563.9    9349.7
 14.75  0.0460     72569.0    9407.8
 15.00  0.0460     69635.1    9446.1
 15.25  0.0460     69814.4    9499.6
 15.50  0.0460     67608.4    9382.8
 16.00  0.1005     66104.1    9467.5
 17.00  0.0460     62508.9    9369.0
 18.00  0.1005     60442.2    9374.7
 20.00  0.1005     49339.3    9027.3
 15.50  0.1005     68458.7    9514.9
 15.25  0.0460     69068.7    9377.6
 15.00  0.0460     70727.2    9395.5
 14.75  0.0460     70987.8    9428.3
 14.50  0.0460     73870.4    9386.0
```

4.13 Re16m Trip wire. Bump tape 0,1 2%

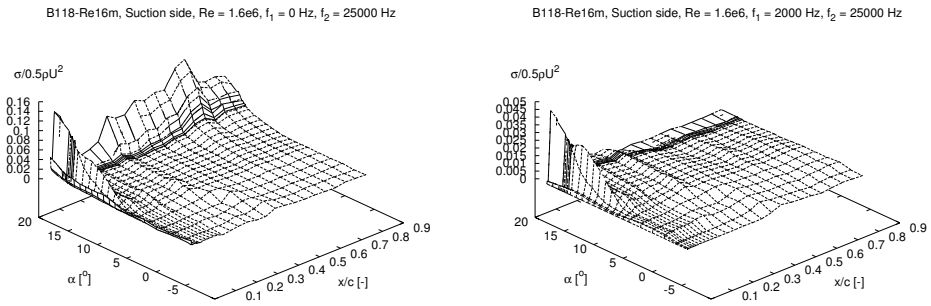

Figure 73: Pressure standard deviations, σ

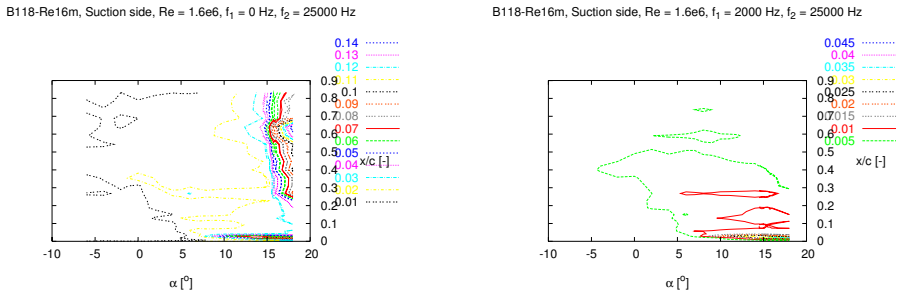

Figure 74: Contours of σ

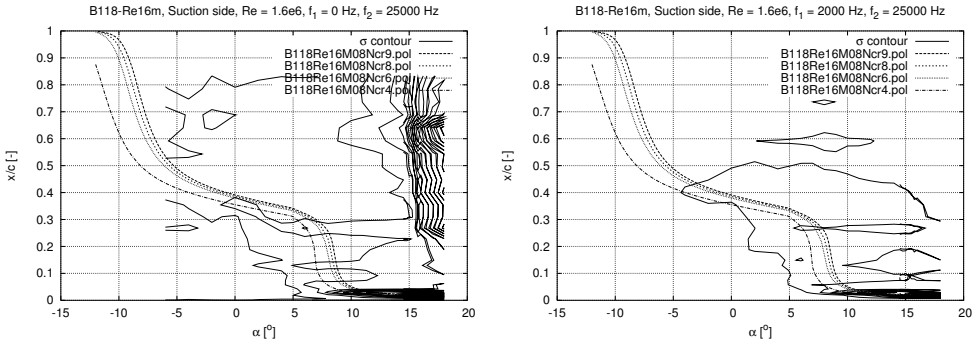

Figure 75: Contours of σ and XFoil data

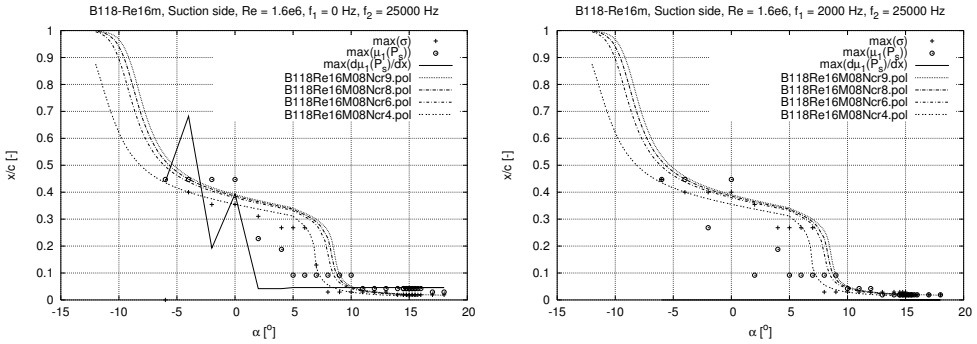

Figure 76: Transition detection

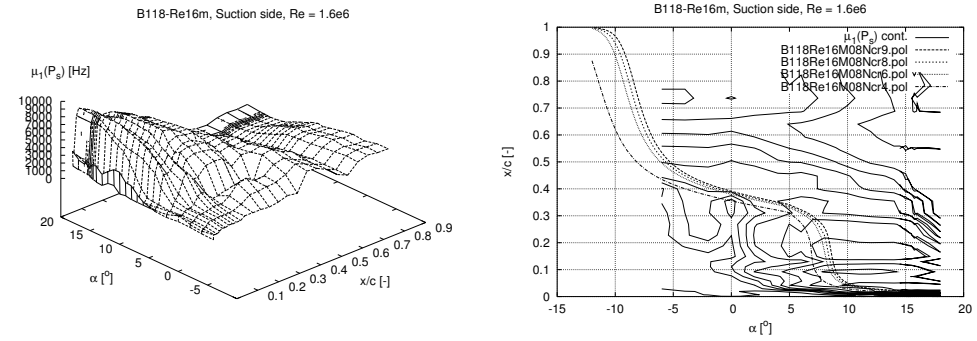

Figure 77: Fourier transform mean, $\mu_1(P_s)$

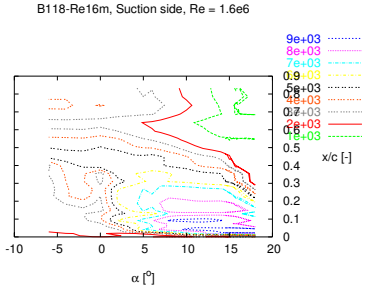

Figure 78: Contours of $\mu_1(P_s)$

```
B118-Re16m
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
 -6.00  0.4395     25059.6    5231.3
 -4.00  0.6823     16667.9    5467.9
 -2.00  0.1925     21530.5    5518.2
  0.00  0.3935     38501.6    5925.2
  2.00  0.0419     51528.6    6131.5
  4.00  0.0419     58618.2    6845.5
  5.00  0.0460     65826.0    7380.5
  6.00  0.0460     71400.2    7865.3
  7.00  0.0460     79212.1    8535.4
  8.00  0.0460     84257.9    9088.0
  9.00  0.0460     82771.8    9233.5
 10.00  0.0460     83712.7    9290.3
 11.00  0.0460     74970.4    9483.2
 12.00  0.0460     77077.8    9604.9
 13.00  0.0460     82604.0    9646.1
 14.00  0.0460     77404.6    9635.9
 14.50  0.0460     74513.3    9702.7
 14.75  0.0460     71558.3    9733.5
 15.00  0.0460     68488.1    9780.5
 15.25  0.0460     67926.0    9739.5
 15.50  0.0460     67025.4    9721.1
 15.75  0.0460     64843.4    9711.4
 16.00  0.0460     61126.1    9770.5
 17.00  0.0460     58012.3    9607.7
 18.00  0.0460     52313.1    9507.8
 15.50  0.0460     66651.8    9742.1
 15.25  0.0460     66617.1    9834.5
 15.00  0.0460     70918.9    9705.3
 14.75  0.0460     71498.0    9743.0
 14.50  0.0460     73584.0    9650.3
```

4.14 Re3a Clean -

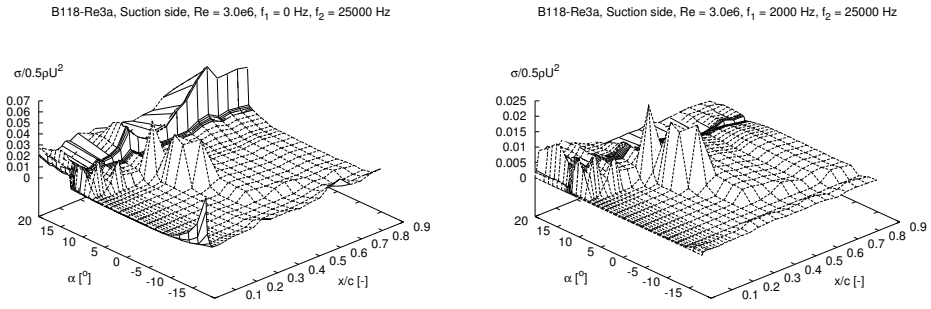

Figure 79: Pressure standard deviations, σ

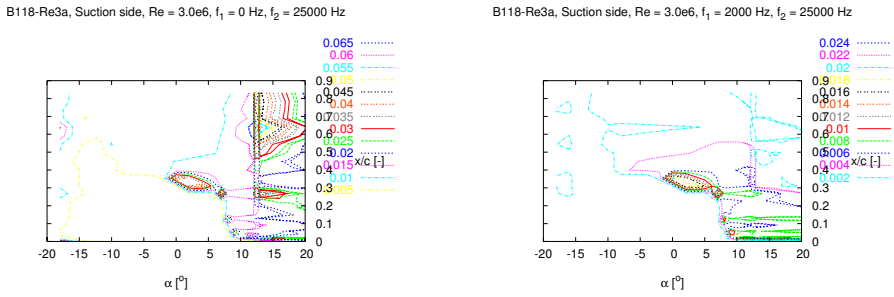

Figure 80: Contours of σ

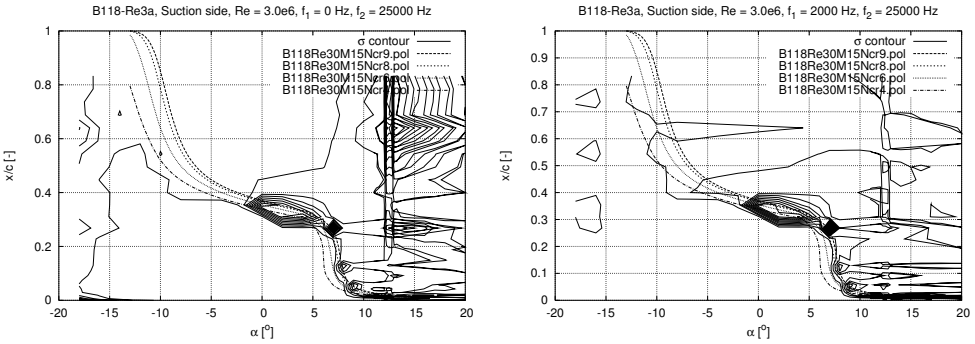

Figure 81: Contours of σ and XFoil data

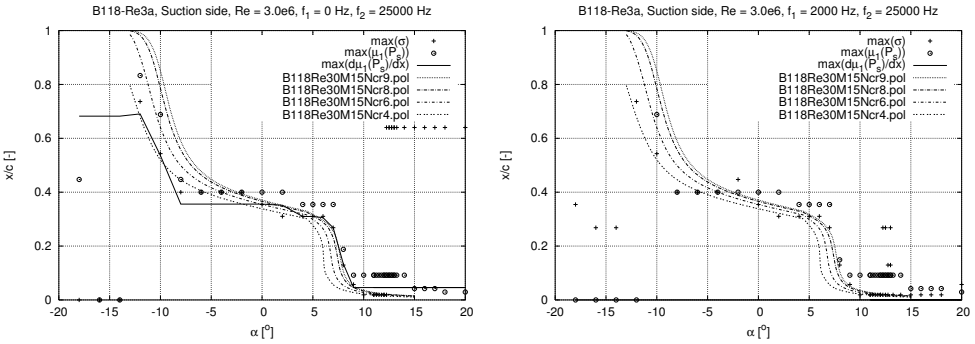

Figure 82: Transition detection

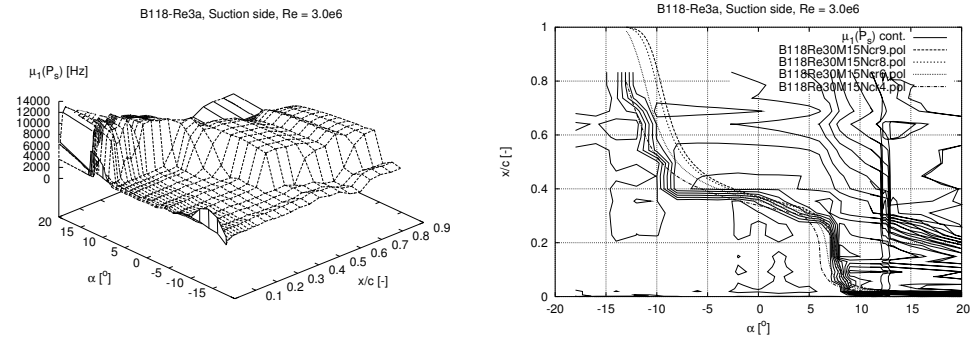

Figure 83: Fourier transform mean, $\mu_1(P_s)$

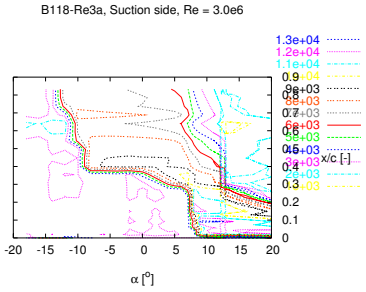

Figure 84: Contours of $\mu_1(P_s)$

```
B118-Re3a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823     18416.4    3767.8
-16.00  0.6823     18663.5    6183.6
-14.00  0.6823     14308.4    7002.6
-12.00  0.6907     54317.7    7916.0
-10.00  0.5358     53303.7    8676.9
 -8.00  0.3558     64614.4    8907.9
 -6.00  0.3558     68653.6    9064.3
 -4.00  0.3558     68045.0    9277.7
 -2.00  0.3558     73670.8    9399.6
  0.00  0.3558     70077.4    9184.7
  2.00  0.3516     60009.1    9127.9
  4.00  0.3098     71225.2    9383.8
  5.00  0.3098     76517.2    9830.1
  6.00  0.3056     77583.3   10096.1
  7.00  0.2679     74647.0   10424.1
  8.00  0.1339     64073.3   12070.1
  9.00  0.0460    108102.8   13340.4
 10.00  0.0460    102213.7   13183.4
 11.00  0.0460     96910.4   13107.3
 12.00  0.0460     96439.4   13042.4
 12.25  0.0460     95979.5   13030.8
 12.50  0.0460     94947.3   13029.5
 12.75  0.0460     91118.8   13000.2
 13.00  0.0460     99644.3   12132.2
 13.25  0.0460     99467.2   12161.2
 14.00  0.0460     97123.8   12001.8
 15.00  0.0460     93568.6   12172.7
 16.00  0.0460     91376.9   12242.5
 17.00  0.0460     89021.7   12241.1
 18.00  0.0460     86424.3   12271.3
 20.00  0.0460     67030.4   12560.1
 13.00  0.0460     99283.4   12195.8
 12.75  0.0460     99855.0   12207.3
 12.50  0.0460    101076.5   12310.0
 12.25  0.0460    100847.2   12333.5
 12.00  0.0460     96596.7   13075.6
 11.75  0.0460     96863.6   13079.3
 11.50  0.0460     97429.4   13103.1
 11.25  0.0460     97507.1   13112.0
 11.00  0.0460     97543.4   13141.7
```

4.15 Re3b ZZ90 x/c=5% suc. x/c=10% press. -

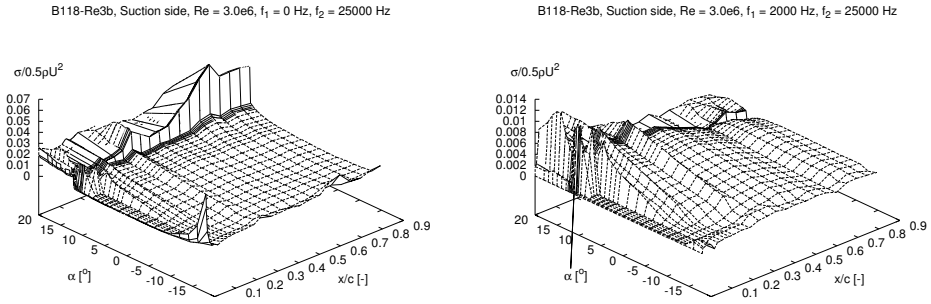

Figure 85: Pressure standard deviations, σ

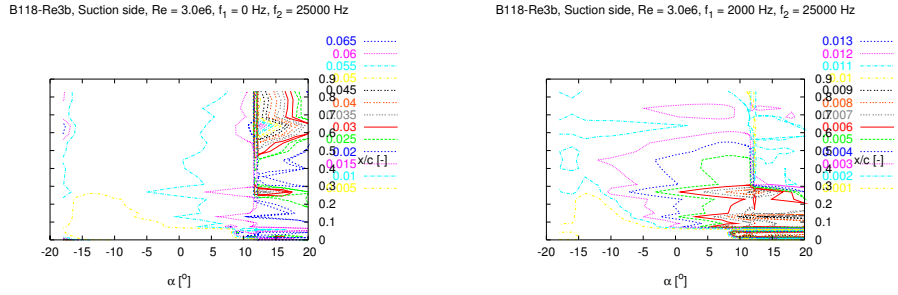

Figure 86: Contours of σ

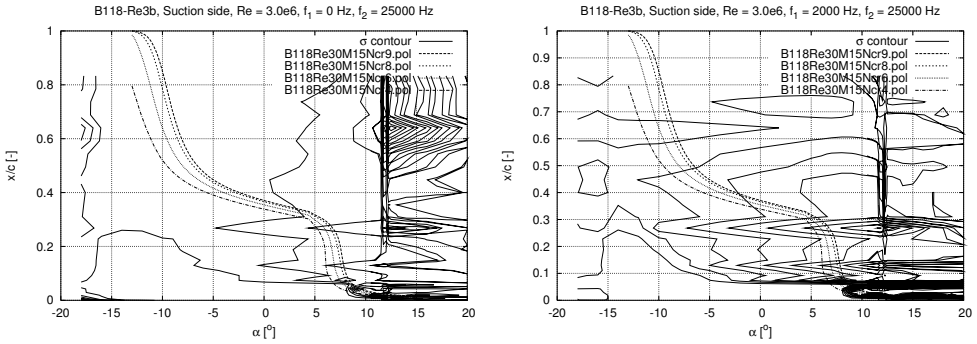

Figure 87: Contours of σ and XFoil data

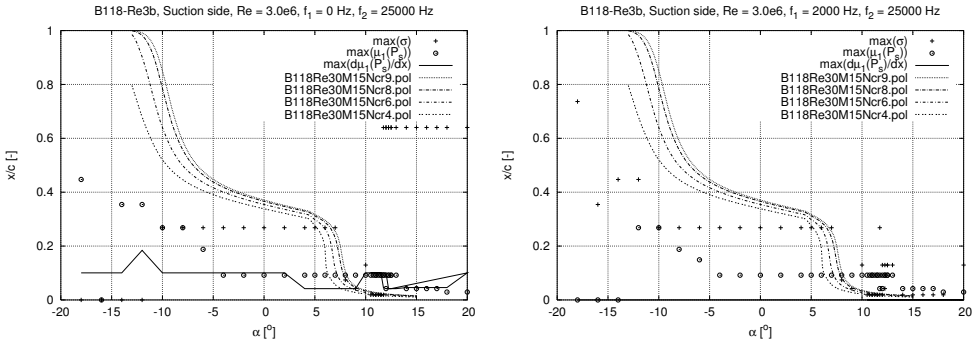

Figure 88: Transition detection

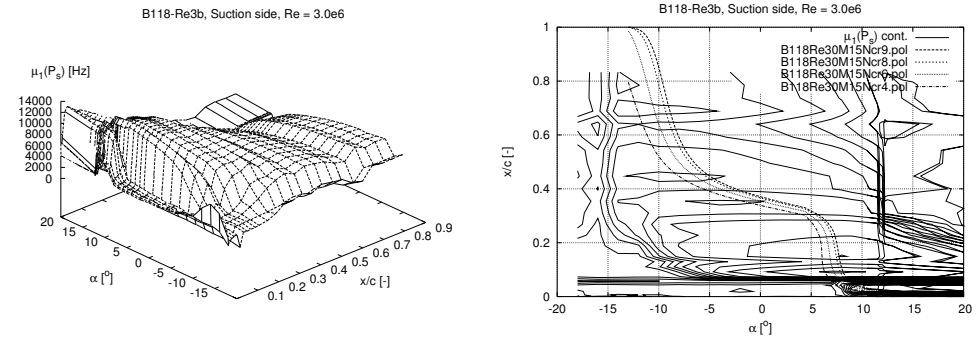

Figure 89: Fourier transform mean, $\mu_1(P_s)$

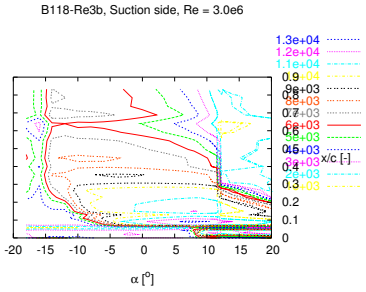

Figure 90: Contours of $\mu_1(P_s)$

```
B118-Re3b
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.1005     27977.4    6147.8
-16.00  0.1005     27140.1    6895.9
-14.00  0.1005     31037.6    8067.7
-12.00  0.1842     42176.2    8213.3
-10.00  0.1005     60813.4    9794.7
 -8.00  0.1005     88500.3   10131.9
 -6.00  0.1005     97201.8   10408.0
 -4.00  0.1005     99751.6   10692.0
 -2.00  0.1005    102220.8   11382.1
  0.00  0.1005    104370.8   11847.6
  2.00  0.1005    106619.1   12297.4
  4.00  0.0419    108969.6   12685.4
  5.00  0.0419    111920.1   12884.9
  6.00  0.0419    112066.9   13031.0
  7.00  0.0419    113456.1   13161.6
  8.00  0.0419    110931.6   13123.2
  9.00  0.0419     91207.4   13058.1
 10.00  0.1005     86448.7   13037.0
 11.00  0.1005     87069.0   12939.7
 11.50  0.1005     86931.1   12909.0
 11.75  0.1005     87190.9   12868.8
 12.00  0.1005     86900.8   12840.8
 12.25  0.0419     98336.8   12345.8
 12.50  0.0419     93371.8   12160.3
 13.00  0.0419     91381.4   12143.0
 14.00  0.0460     88775.2   12016.5
 15.00  0.0460     87327.3   12171.7
 16.00  0.0460     84687.6   12263.6
 17.00  0.0460     82630.4   12290.6
 18.00  0.0460     80353.5   12372.4
 20.00  0.1005     61273.2   12675.6
 12.50  0.0419     92568.9   12227.1
 12.25  0.0419     93229.9   12269.3
 12.00  0.0419     93390.5   12322.0
 11.75  0.0460     92701.4   12356.8
 11.50  0.1005     87191.2   12903.5
 11.25  0.1005     86830.9   12928.3
 11.00  0.1005     87334.4   12967.7
 10.75  0.1005     87245.1   12971.5
 10.50  0.1005     87050.8   12992.1
```

4.16 Re3c LM standard LER. ZZ 2% -

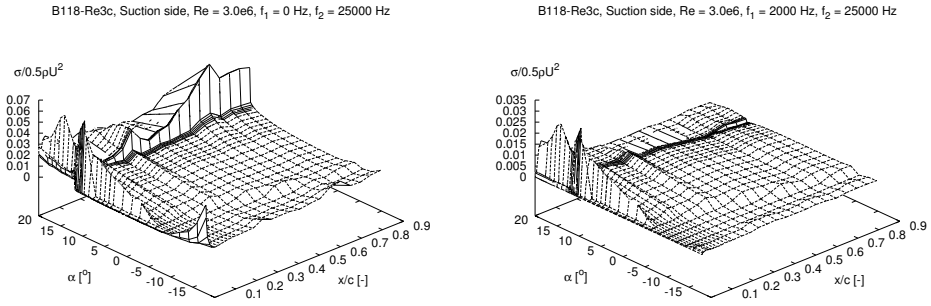

Figure 91: Pressure standard deviations, σ

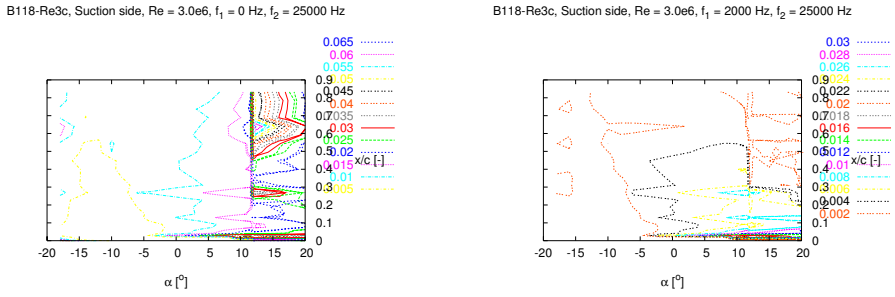

Figure 92: Contours of σ

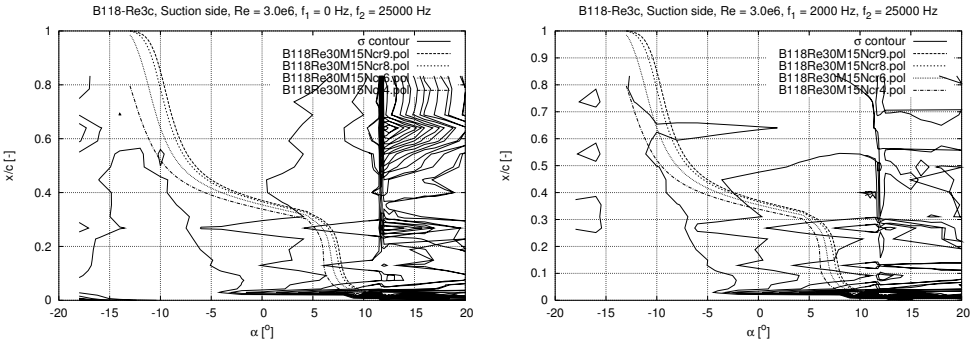

Figure 93: Contours of σ and XFoil data

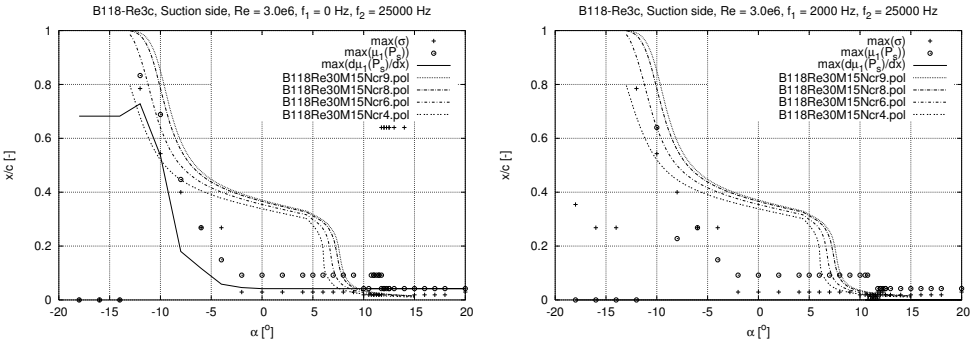

Figure 94: Transition detection

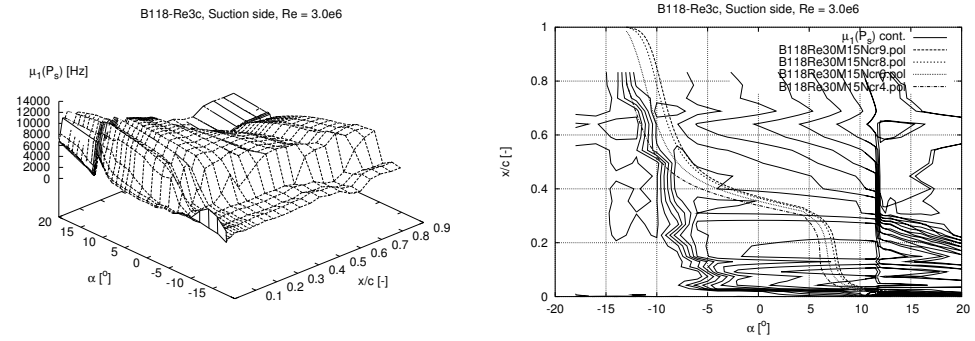

Figure 95: Fourier transform mean, $\mu_1(P_s)$

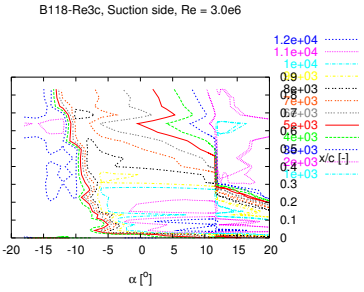

Figure 96: Contours of $\mu_1(P_s)$

```
B118-Re3c
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823     18618.9    4621.7
-16.00  0.6823     18517.7    6310.1
-14.00  0.6823     14427.5    7097.6
-12.00  0.7283     50491.8    7748.0
-10.00  0.5358     53742.3    8691.1
 -8.00  0.1800     47137.4    8886.3
 -6.00  0.1172     67361.1   10371.2
 -4.00  0.0586     71663.7   10774.5
 -2.00  0.0460     92023.5   11346.3
  0.00  0.0419     95109.0   11689.1
  2.00  0.0419     99713.9   11966.8
  4.00  0.0419     99824.1   12249.5
  5.00  0.0419    101702.5   12384.4
  6.00  0.0419    100124.7   12477.2
  7.00  0.0419     99597.7   12603.0
  8.00  0.0419     99279.0   12677.8
  9.00  0.0419     91696.8   12749.6
 10.00  0.0419     71601.3   12893.0
 11.00  0.0419     60863.2   12838.2
 11.50  0.0419     57631.4   12830.8
 11.75  0.0419     57223.2   12817.5
 12.00  0.0419     94790.5   12329.1
 12.50  0.0419     91004.8   12285.1
 13.00  0.0419     87261.8   12349.9
 14.00  0.0419     79996.7   12258.1
 15.00  0.0419     72159.8   12135.3
 16.00  0.0419     66288.5   12066.0
 17.00  0.0419     60045.4   11963.8
 18.00  0.0419     53169.4   11818.4
 20.00  0.0419     44000.0   11571.7
 12.50  0.0419     89477.4   12349.3
 12.25  0.0419     91330.5   12312.8
 12.00  0.0419     90040.8   12324.7
 11.75  0.0419     91060.6   12308.1
 11.50  0.0419     57334.6   12842.1
 11.25  0.0419     58361.2   12837.5
 11.00  0.0419     60562.1   12837.2
 10.75  0.0419     62262.7   12827.9
 10.50  0.0419     64234.0   12850.1
```

4.17 Re3d Trip wire. Bump tape 2% -

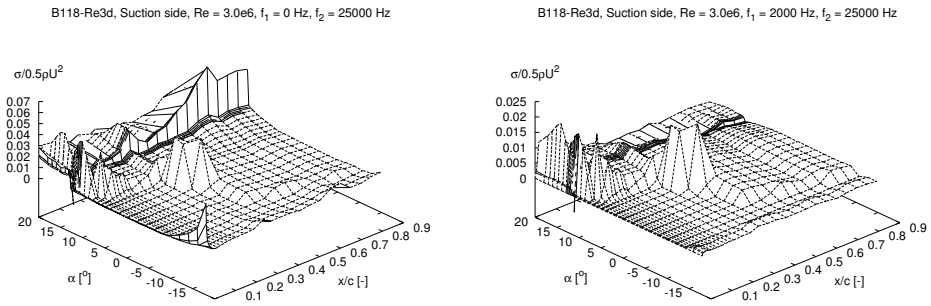

Figure 97: Pressure standard deviations, σ

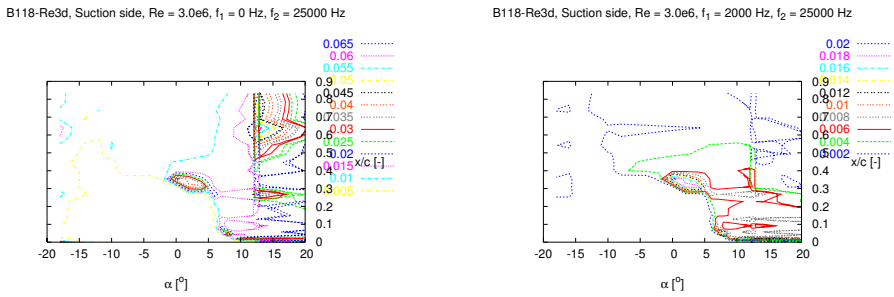

Figure 98: Contours of σ

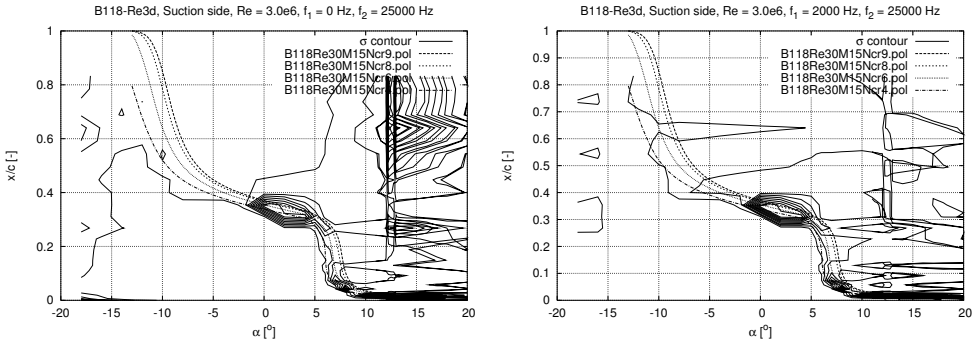

Figure 99: Contours of σ and XFoil data

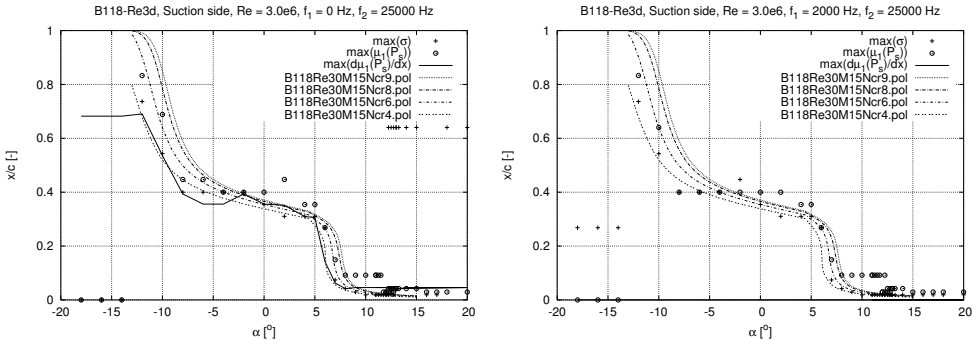

Figure 100: Transition detection

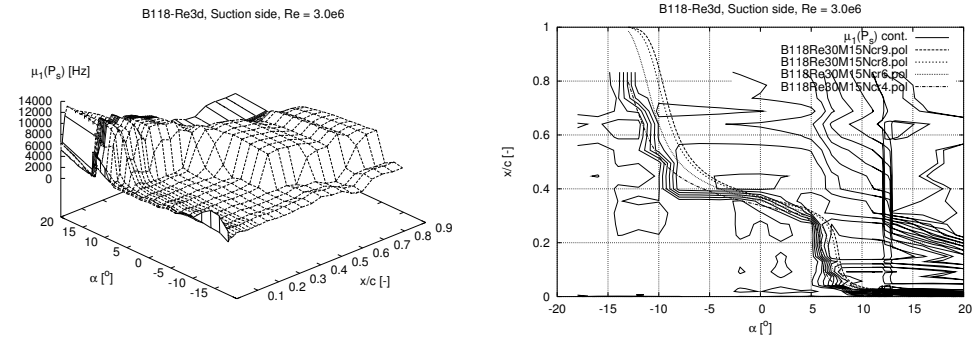

Figure 101: Fourier transform mean, $\mu_1(P_s)$

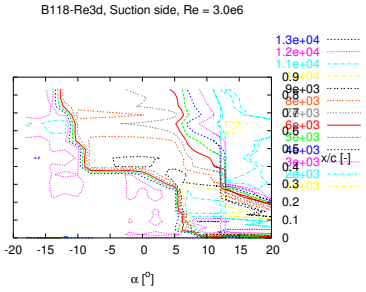

Figure 102: Contours of $\mu_1(P_s)$

```
B118-Re3d
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823     18801.6    4573.3
-16.00  0.6823     18580.9    6506.2
-14.00  0.6823     15457.6    6778.0
-12.00  0.6907     53882.2    7863.4
-10.00  0.5358     53073.8    8638.3
 -8.00  0.3935     63401.8    8859.8
 -6.00  0.3558     66192.3    8955.3
 -4.00  0.3558     65479.1    9024.4
 -2.00  0.3935     71337.6    9167.7
  0.00  0.3558     70461.9    9231.6
  2.00  0.3516     56479.9    9016.1
  4.00  0.3098     71146.1    9385.6
  5.00  0.3056     72626.2    9766.3
  6.00  0.1423     50954.5    9918.5
  7.00  0.0628     82300.2   11849.1
  8.00  0.0419    111650.7   12933.4
  9.00  0.0460    104761.5   13079.6
 10.00  0.0460     95904.5   13034.3
 11.00  0.0460     88624.0   13011.2
 12.00  0.0460     80243.2   13073.5
 12.25  0.0460     77613.1   13159.2
 12.50  0.0460     75016.6   13217.9
 12.75  0.0460     73773.4   13244.3
 13.00  0.0419    100423.0   12264.9
 13.25  0.0419     98277.0   12285.0
 14.00  0.0460     93802.3   12269.4
 15.00  0.0460     89870.2   12316.3
 16.00  0.0460     85683.2   12411.5
 17.00  0.0460     77429.9   12388.7
 18.00  0.0460     72592.8   12570.5
 20.00  0.0460     55722.4   12700.6
 13.00  0.0419     97574.4   12278.7
 12.75  0.0419    100245.5   12253.8
 12.50  0.0419    100996.8   12239.9
 12.25  0.0419    100485.8   12249.2
 12.00  0.0460     79386.6   13141.9
 11.75  0.0460     83092.4   13061.1
 11.50  0.0460     85381.6   13026.5
 11.25  0.0460     86689.4   13020.8
 11.00  0.0460     88732.6   13052.8
```

4.18 Re3e Clean -

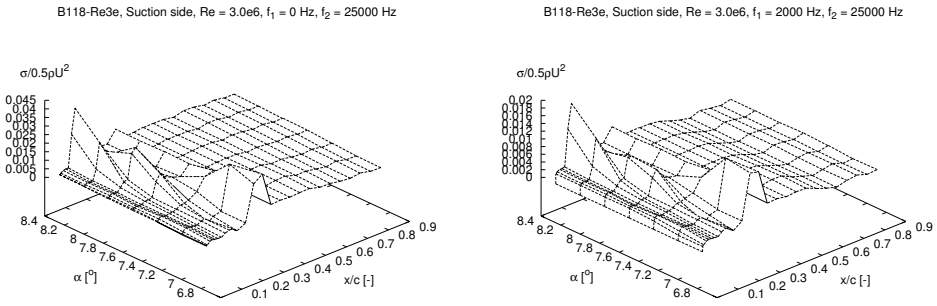

Figure 103: Pressure standard deviations, σ

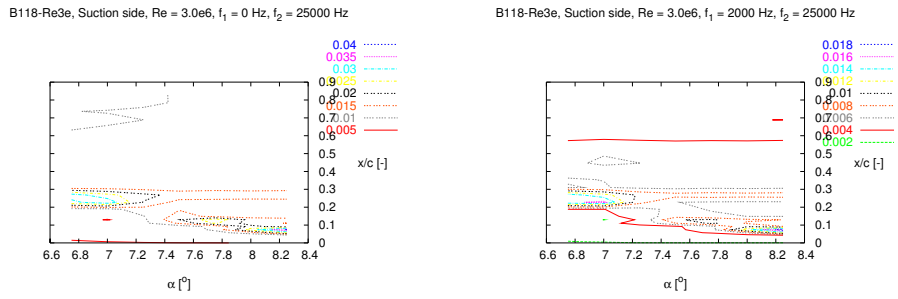

Figure 104: Contours of σ

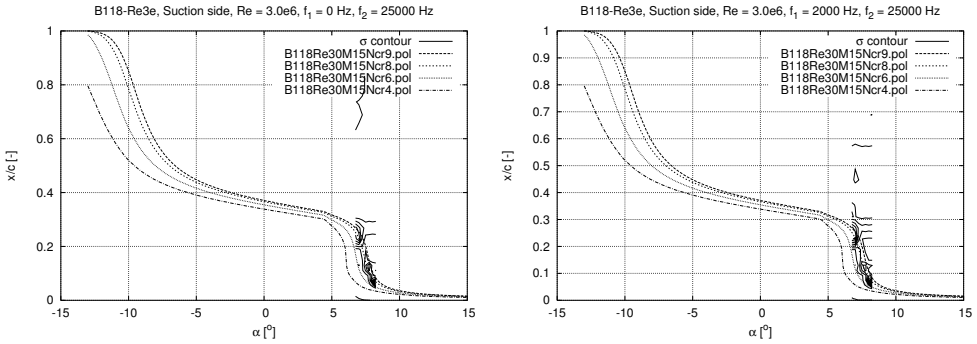

Figure 105: Contours of σ and XFoil data

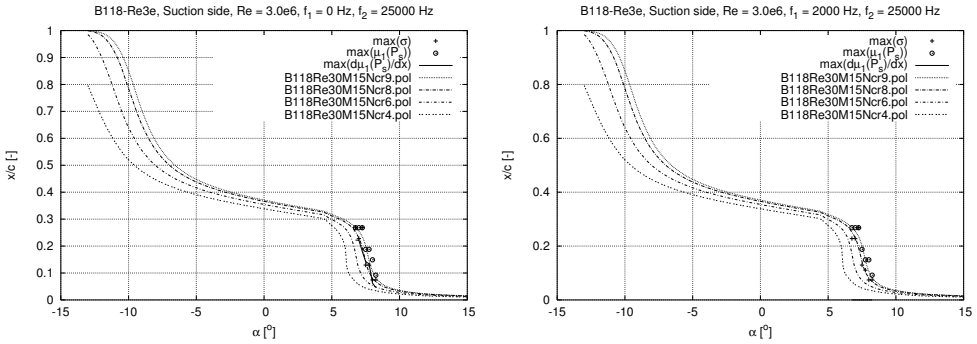

Figure 106: Transition detection

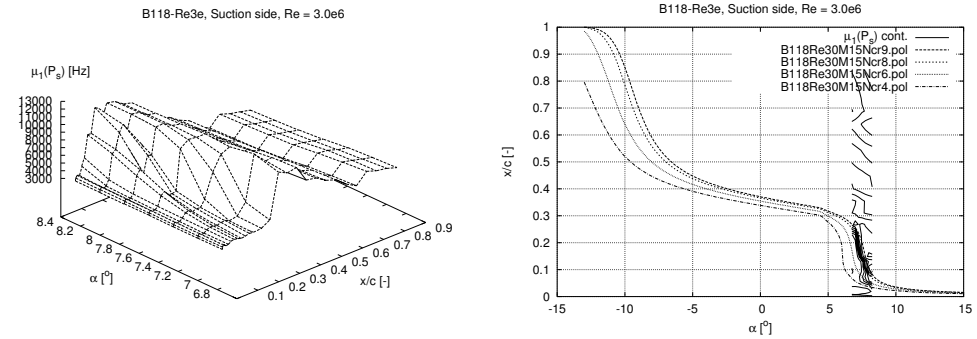

Figure 107: Fourier transform mean, $\mu_1(P_s)$

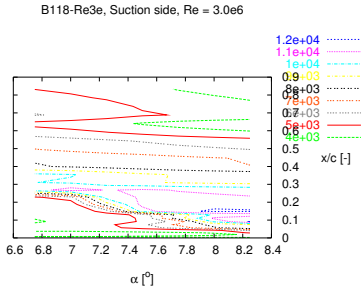

Figure 108: Contours of $\mu_1(P_s)$

```
B118-Re3e
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
  6.75  0.2218     72186.2   10578.9
  7.00  0.2218     81780.8   11473.4
  7.25  0.1800     61290.5   10935.9
  7.50  0.1423     70470.5   11300.9
  7.75  0.1339     61832.1   11882.2
  8.00  0.0628     81289.8   12077.7
  8.25  0.0460     90932.9   12065.9
```

4.19 Re3f Clean 200x200

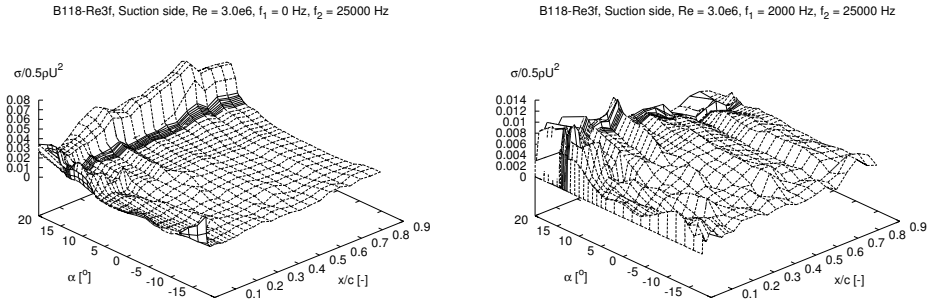

Figure 109: Pressure standard deviations, σ

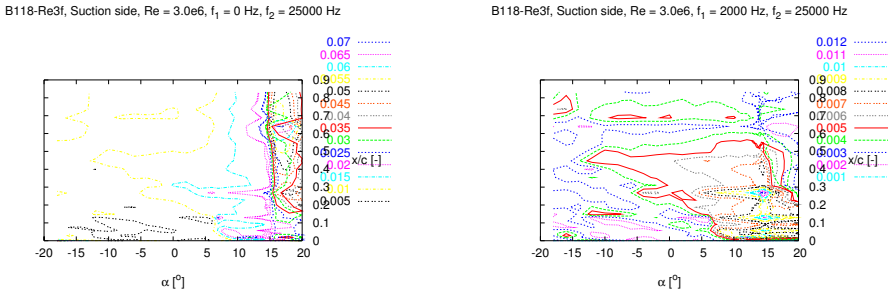

Figure 110: Contours of σ

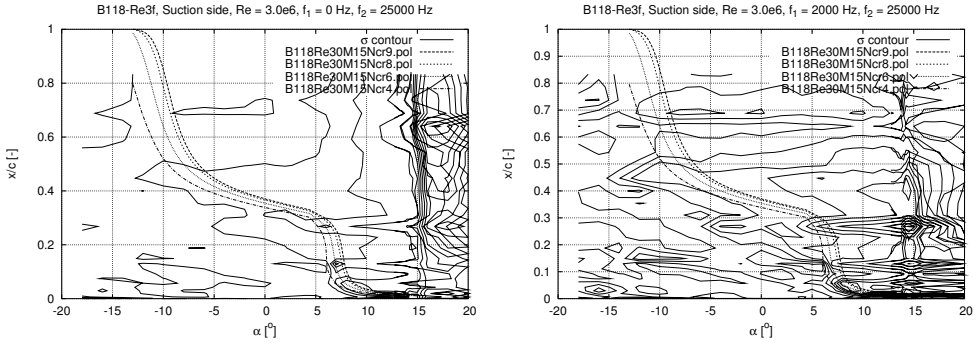

Figure 111: Contours of σ and XFoil data

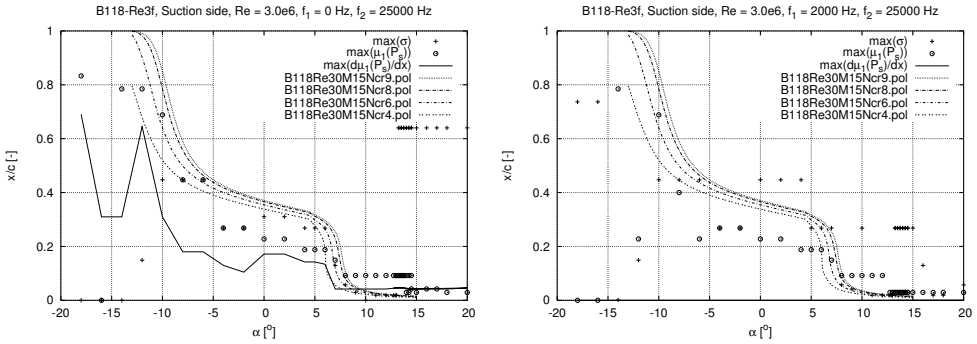

Figure 112: Transition detection

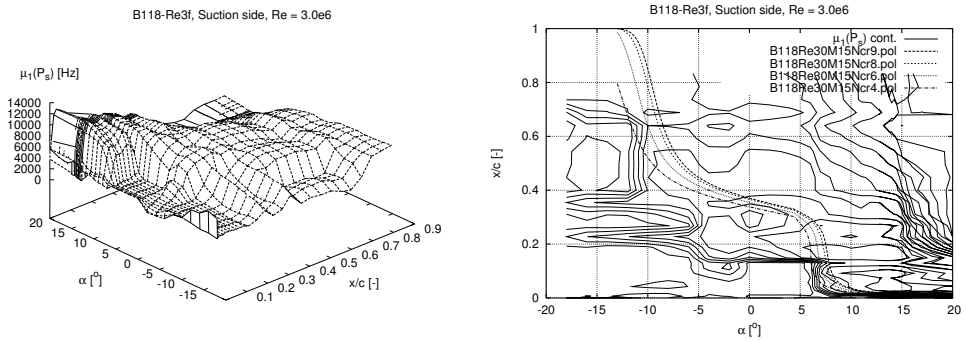

Figure 113: Fourier transform mean, $\mu_1(P_s)$

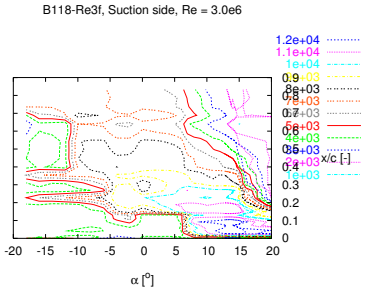

Figure 114: Contours of $\mu_1(P_s)$

```
B118-Re3f
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     49397.8    7578.3
-16.00  0.3098     36445.4    7686.7
-14.00  0.3098     40263.0    7534.6
-12.00  0.6446     44180.0    7626.6
-10.00  0.3098     41857.4    8262.3
 -8.00  0.1800     43470.7    8488.4
 -6.00  0.1800     50841.9    8584.9
 -4.00  0.1298     48502.6    9755.1
 -2.00  0.1046     52385.1    9980.1
  0.00  0.1716     67696.1    9897.7
  2.00  0.1716     73754.1   10275.9
  4.00  0.1423     77516.6   10505.0
  5.00  0.1423     82439.0   10930.4
  6.00  0.1339     78900.9   11159.4
  7.00  0.0419     72593.8   11315.0
  8.00  0.0419     90520.1   11810.7
  9.00  0.0419     93950.5   11987.4
 10.00  0.0419     93300.8   12116.8
 11.00  0.0419     88909.1   12146.8
```

12.00	0.0419	91720.9	12285.5
13.00	0.0460	93722.2	12597.8
13.25	0.0460	88783.0	12634.4
13.50	0.0460	86410.2	12653.0
13.75	0.0460	84539.0	12677.0
14.00	0.0460	83174.7	12711.9
14.25	0.0419	81274.9	12575.0
14.50	0.0419	79796.6	12637.7
15.00	0.0419	81178.4	12669.3
16.00	0.0419	76774.4	11960.2
17.00	0.0419	71932.3	11841.2
18.00	0.0419	67853.5	11976.8
20.00	0.0460	59738.9	12421.7
14.50	0.0419	79014.6	12534.4
14.25	0.0419	80175.9	12575.9
14.00	0.0419	82051.7	12611.1
13.75	0.0460	84648.3	12690.2
13.50	0.0460	86079.2	12673.3
13.25	0.0460	88532.2	12667.4
13.00	0.0460	91801.2	12611.9
12.75	0.0460	94668.7	12543.5

4.20 Re3g ZZ90 x/c=5% suc. x/c=10% press. 200x200

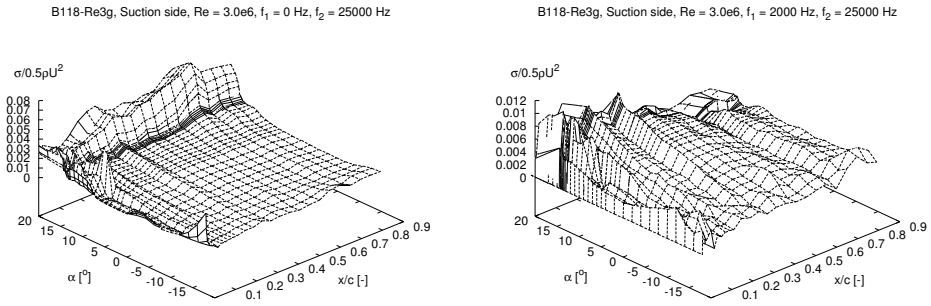

Figure 115: Pressure standard deviations, σ

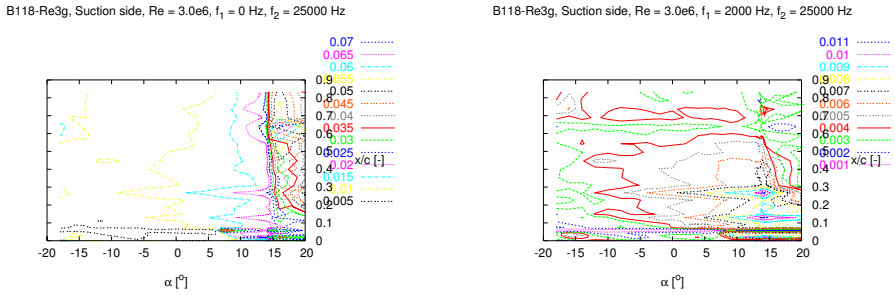

Figure 116: Contours of σ

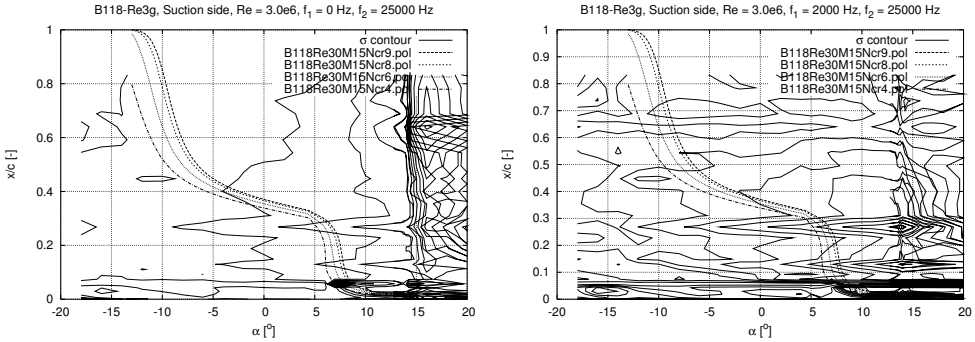

Figure 117: Contours of σ and XFoil data

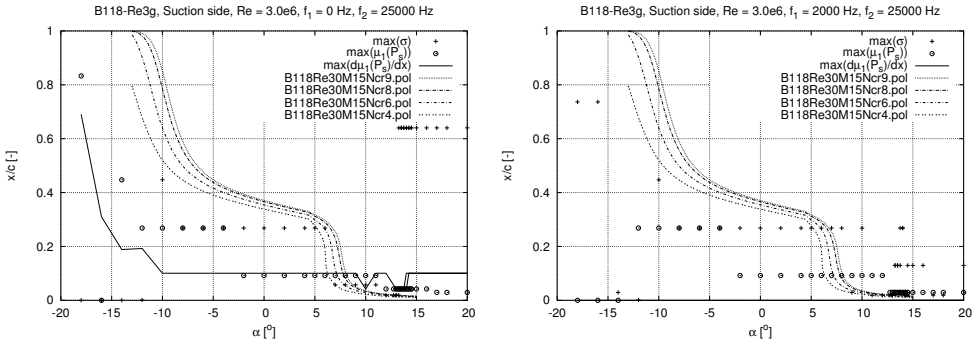

Figure 118: Transition detection

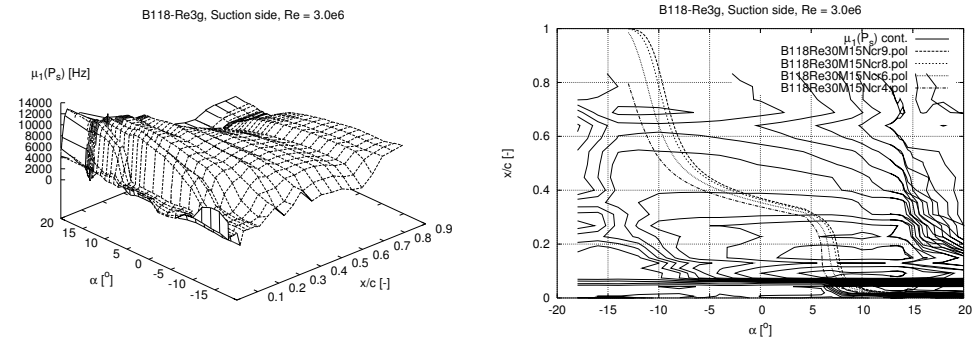

Figure 119: Fourier transform mean, $\mu_1(P_s)$

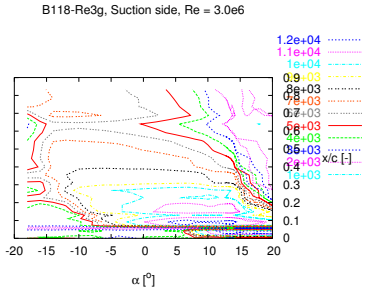

Figure 120: Contours of $\mu_1(P_s)$

```
B118-Re3g
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     44912.3    7586.9
-16.00  0.3098     29291.4    7565.6
-14.00  0.1884     36325.1    7618.0
-12.00  0.1925     41797.5    8239.0
-10.00  0.1005     46953.6    9490.5
 -8.00  0.1005     71302.9    9724.5
 -6.00  0.1005     84583.1    9996.2
 -4.00  0.1005     92247.6   10003.7
 -2.00  0.1005     94566.4   10248.9
  0.00  0.1005     95677.4   10973.1
  2.00  0.1005     98247.6   11491.3
  4.00  0.1005    100374.0   12060.4
  5.00  0.1005    102029.4   12347.1
  6.00  0.1005    104171.2   12563.0
  7.00  0.1005    108371.6   12625.1
  8.00  0.1005    102638.1   12187.8
  9.00  0.1005     95870.9   12082.7
 10.00  0.0419     94740.3   12109.9
 11.00  0.1005     91276.4   12134.5
```

```
12.00  0.1005     90881.7   12237.7
13.00  0.0419     90071.7   12583.1
13.25  0.0419     88943.8   12615.8
13.50  0.0419     87900.3   12635.1
13.75  0.0419     85793.4   12536.3
14.00  0.1005     85627.4   12509.9
14.25  0.1005     88640.2   12226.3
14.50  0.1005     88251.2   12262.7
15.00  0.1005     86207.0   12161.8
16.00  0.1005     78853.3   11839.0
17.00  0.1005     76352.9   11933.0
18.00  0.1005     72764.5   12319.3
20.00  0.1005     59848.9   12440.4
14.50  0.1005     89721.5   12164.0
14.25  0.1005     88929.9   12272.9
14.00  0.0419     84961.4   12553.5
13.75  0.0419     86539.8   12609.1
13.50  0.0460     87631.7   12608.0
13.25  0.0460     89336.2   12596.2
13.00  0.0419     90185.4   12557.0
12.75  0.0419     90556.4   12525.3
```

4.21 Re3h LER. ZZ 2% 200x200

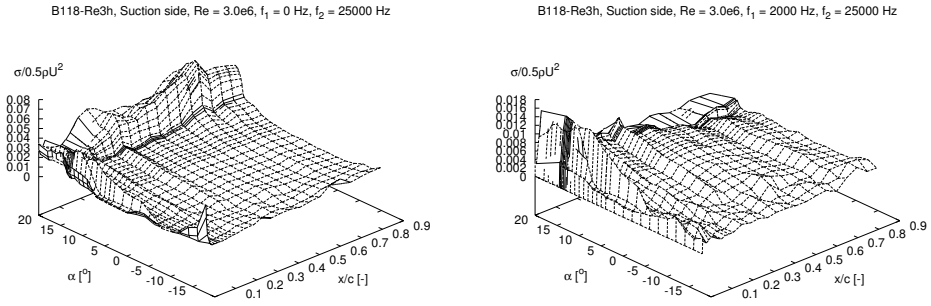

Figure 121: Pressure standard deviations, σ

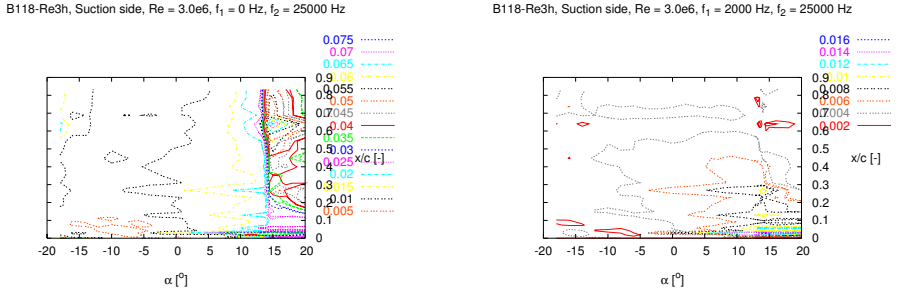

Figure 122: Contours of σ

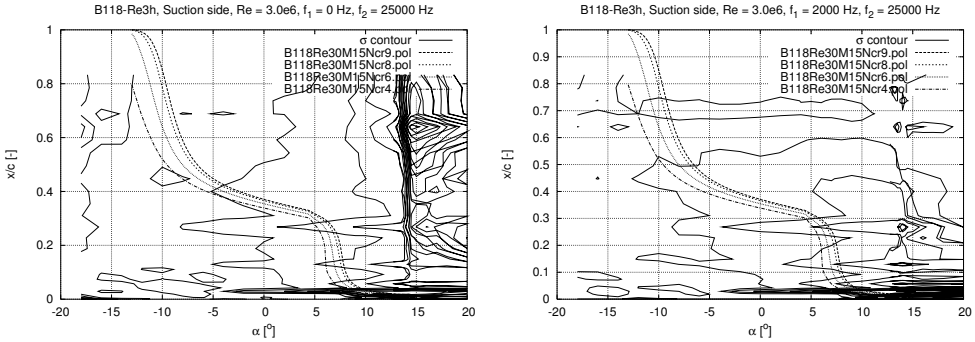

Figure 123: Contours of σ and XFoil data

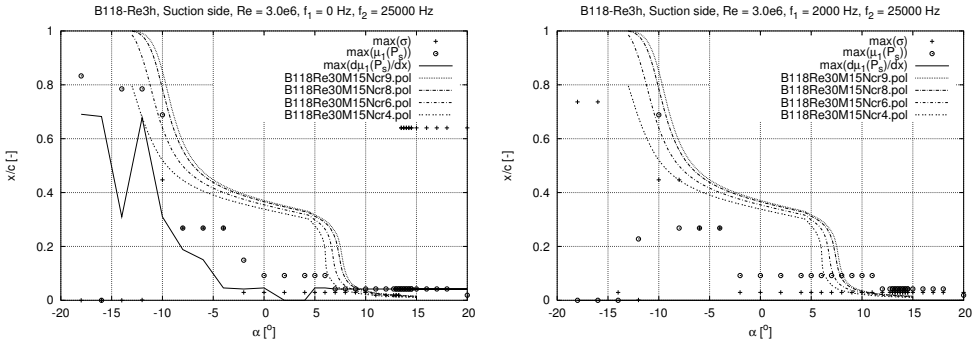

Figure 124: Transition detection

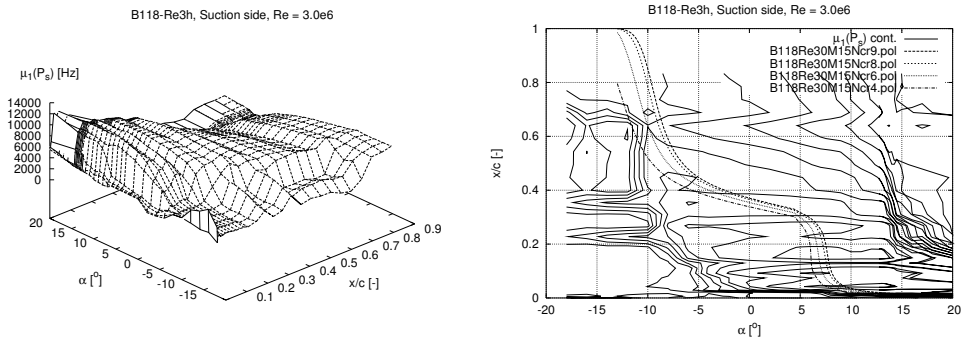

Figure 125: Fourier transform mean, $\mu_1(P_s)$

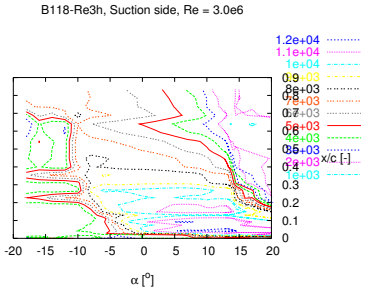

Figure 126: Contours of $\mu_1(P_s)$

```
B118-Re3h
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     51514.2    7412.6
-16.00  0.6823     31548.2    8000.3
-14.00  0.3098     42225.4    7567.7
-12.00  0.6781     45709.4    7617.6
-10.00  0.3098     42619.2    8305.3
 -8.00  0.1884     45335.0    9258.8
 -6.00  0.1507     58063.4   10146.4
 -4.00  0.0460     65155.6   10056.2
 -2.00  0.0419     87434.3   10235.1
  0.00  0.0460     76825.0   10855.3
  2.00  0.0000     83778.4   11218.0
  4.00  0.0000     85898.9   11734.2
  5.00  0.0460     88702.2   11999.9
  6.00  0.0460     90405.7   12163.7
  7.00  0.0419     95931.6   12218.6
  8.00  0.0419     95025.8   12111.4
  9.00  0.0419     92514.0   12107.9
 10.00  0.0419     92376.9   12176.8
 11.00  0.0419     87182.2   12221.5
```

```
12.00  0.0419     86053.8   12243.2
13.00  0.0419     85772.4   12268.1
13.25  0.0419     84919.7   12254.8
13.50  0.0419     83392.8   12212.6
13.75  0.0419     82526.2   12121.7
14.00  0.0419     81073.3   12091.4
14.25  0.0419     79975.4   12062.2
14.50  0.0419     77419.4   11951.5
15.00  0.0419     74751.6   11905.4
16.00  0.0419     69225.1   11878.9
17.00  0.0419     64255.3   11856.1
18.00  0.0419     58104.9   11845.8
20.00  0.0419     49767.4   11842.5
14.50  0.0419     78581.8   11984.7
14.25  0.0419     80196.1   12066.7
14.00  0.0419     81293.8   12098.4
13.75  0.0419     82373.8   12153.9
13.50  0.0419     83160.6   12219.2
13.25  0.0419     84280.7   12252.2
13.00  0.0419     84768.6   12255.8
12.75  0.0419     85297.8   12265.0
```

4.22 Re3i Trip wire. Bump tape 0,1 2% 200x200

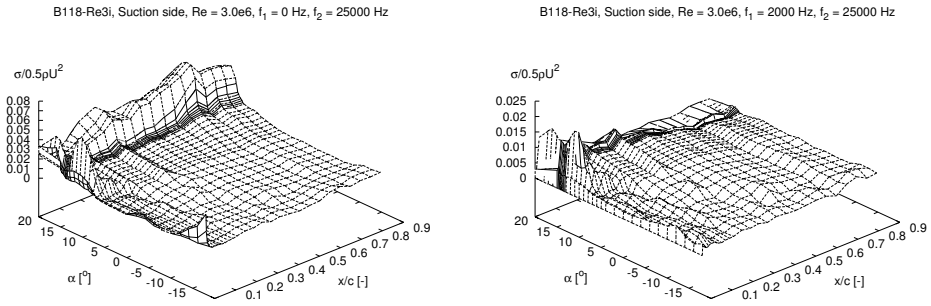

Figure 127: Pressure standard deviations, σ

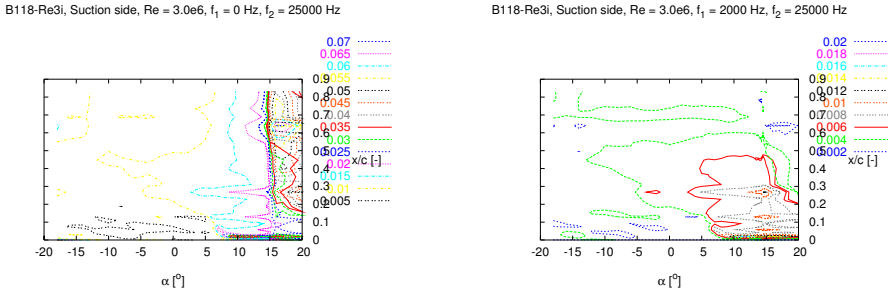

Figure 128: Contours of σ

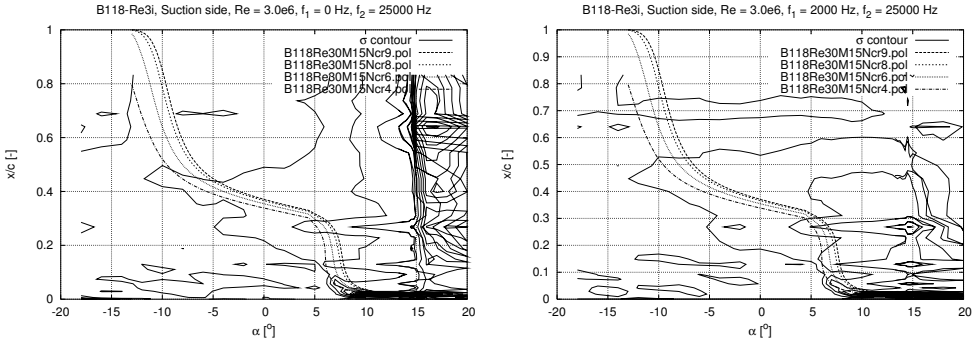

Figure 129: Contours of σ and XFoil data

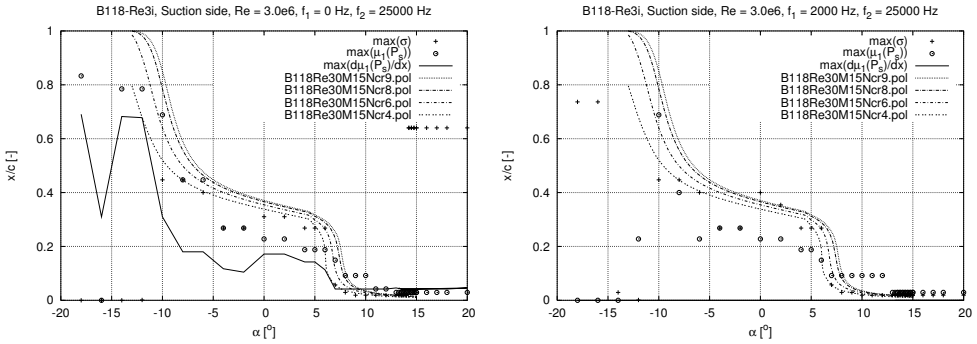

Figure 130: Transition detection

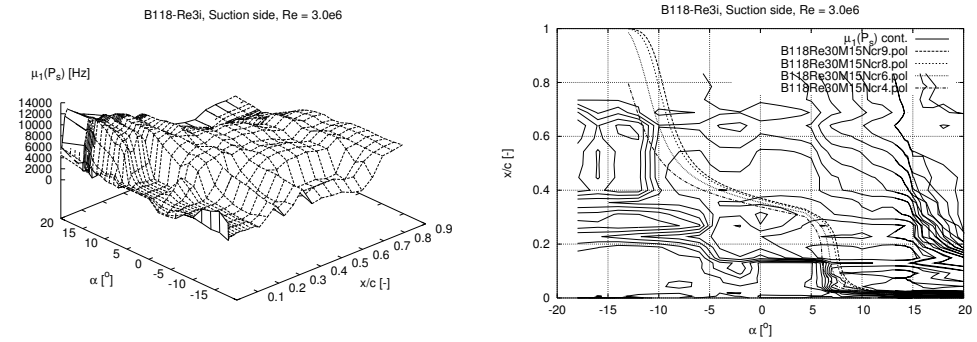

Figure 131: Fourier transform mean, $\mu_1(P_s)$

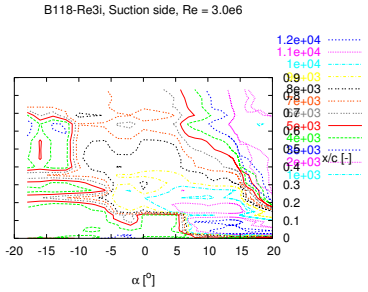

Figure 132: Contours of $\mu_1(P_s)$

```
B118-Re3i
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6907     51704.1    7626.1
-16.00  0.3098     34978.0    7626.8
-14.00  0.6823     44661.2    7571.3
-12.00  0.6781     45100.2    7626.0
-10.00  0.3098     42637.9    8273.3
 -8.00  0.1800     42455.7    8515.0
 -6.00  0.1800     51190.7    8688.0
 -4.00  0.1172     50650.9    9842.0
 -2.00  0.1046     47979.1   10048.4
  0.00  0.1716     69062.4    9978.7
  2.00  0.1716     74497.3   10267.8
  4.00  0.1423     81495.4   10852.2
  5.00  0.1423     83636.7   11146.9
  6.00  0.1130     62381.2   11311.6
  7.00  0.0419     84599.9   11626.6
  8.00  0.0419     95315.0   12130.2
  9.00  0.0419     95810.6   12041.3
 10.00  0.0419     95490.9   12122.5
 11.00  0.0419     90916.1   12227.7
```

```
12.00  0.0419     91751.8   12360.1
13.00  0.0460     91148.8   12812.8
13.50  0.0419     85185.8   12888.9
13.75  0.0419     82484.5   12927.9
14.00  0.0419     81167.4   12944.5
14.25  0.0419     80406.1   12978.3
14.50  0.0419     79327.3   12887.5
14.75  0.0419     79867.4   12923.3
15.00  0.0419     80954.4   12834.1
16.00  0.0419     76770.9   12175.2
17.00  0.0419     71891.2   12098.0
18.00  0.0419     65511.6   12304.1
20.00  0.0460     55705.1   12468.6
15.00  0.0419     80712.0   12644.4
14.75  0.0419     80229.3   12796.3
14.50  0.0419     80039.5   12828.8
14.25  0.0419     80881.1   12949.4
14.00  0.0419     81378.4   12929.7
13.75  0.0419     81999.5   12936.2
13.50  0.0419     84444.6   12873.1
13.25  0.0460     88229.9   12864.7
```

4.23 Re3j Clean 100x100

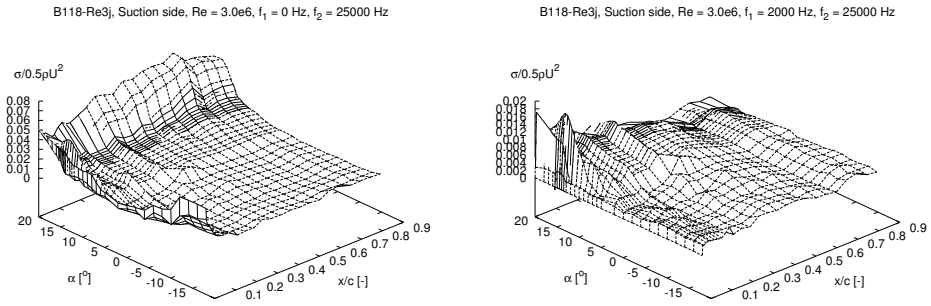

Figure 133: Pressure standard deviations, σ

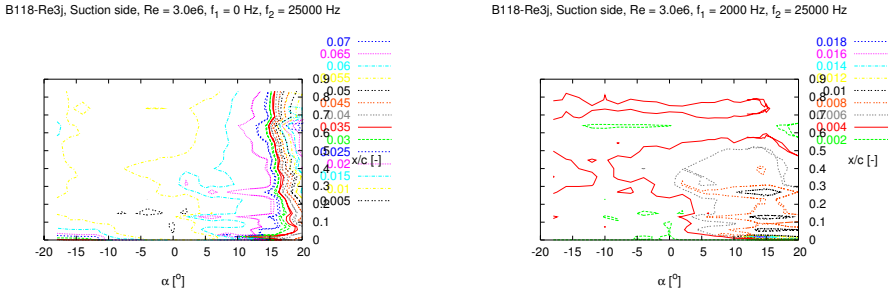

Figure 134: Contours of σ

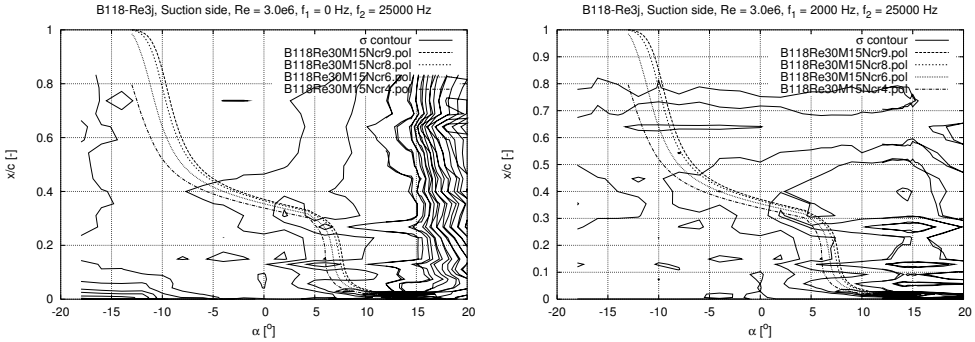

Figure 135: Contours of σ and XFoil data

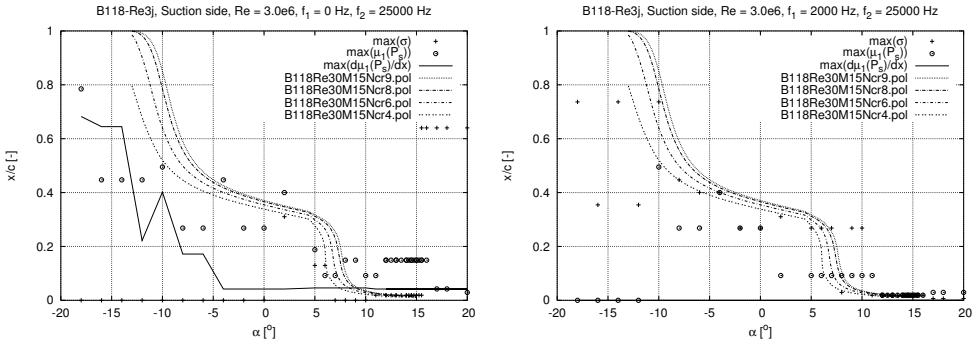

Figure 136: Transition detection

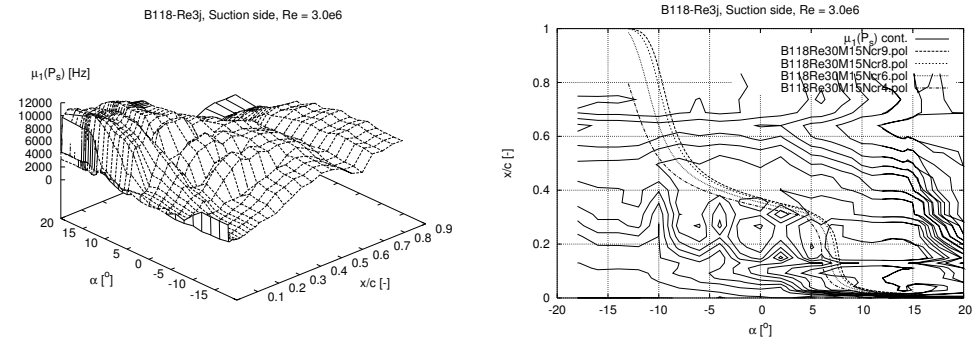

Figure 137: Fourier transform mean, $\mu_1(P_s)$

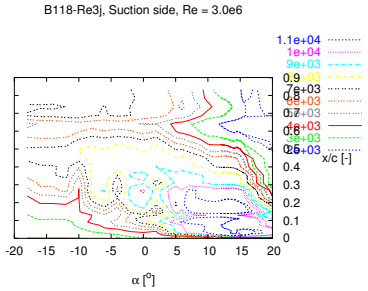

Figure 138: Contours of $\mu_1(P_s)$

```
B118-Re3j
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823     24134.3    7316.6
-16.00  0.6446     23987.5    7505.6
-14.00  0.6446     23376.3    7536.9
-12.00  0.2218     26991.4    7757.1
-10.00  0.4018     25761.1    8090.9
 -8.00  0.1716     37338.4    8619.8
 -6.00  0.1716     38738.1    9120.5
 -4.00  0.0419     35460.2    8944.6
 -2.00  0.0419     41078.0    9623.3
  0.00  0.0419     58083.0   10159.3
  2.00  0.0419     68136.3    9000.3
  5.00  0.0460     88884.0   11092.4
  6.00  0.0460     96087.0   11078.4
  7.00  0.0460    100023.4   11595.7
  8.00  0.0460     96334.6   11818.7
  9.00  0.0460     92256.3   11838.1
 10.00  0.0460     87945.2   11909.2
 11.00  0.0419     88619.1   11916.5
 12.00  0.0419     87279.9   11770.4
```

```
13.00  0.0419     77567.0   11914.8
14.00  0.0419     66778.2   11959.7
14.25  0.0419     67208.5   11924.3
14.50  0.0419     69805.3   11826.7
14.75  0.0419     69983.0   11782.9
15.00  0.0419     71306.2   11647.5
15.25  0.0419     72833.6   11565.7
15.50  0.0419     70536.0   11589.5
16.00  0.0419     71572.3   11476.1
17.00  0.0419     70591.8   11262.2
18.00  0.0419     69033.8   11125.7
20.00  0.0419     58786.3   10519.4
15.50  0.0419     71893.4   11570.7
15.00  0.0419     70868.9   11659.1
14.50  0.0419     68836.3   11797.7
14.00  0.0419     67722.7   11950.1
13.50  0.0419     71506.2   11917.2
13.00  0.0419     77737.5   11873.9
12.50  0.0419     82176.6   11827.1
12.00  0.0419     86759.2   11790.9
```

4.24 Re3k ZZ90 x/c=5% suc. x/c=10% press.

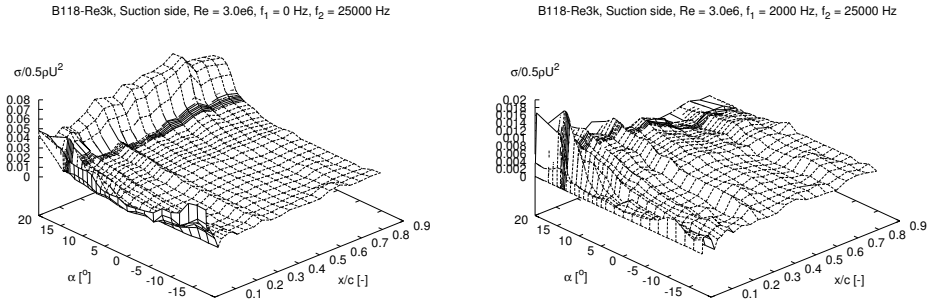

Figure 139: Pressure standard deviations, σ

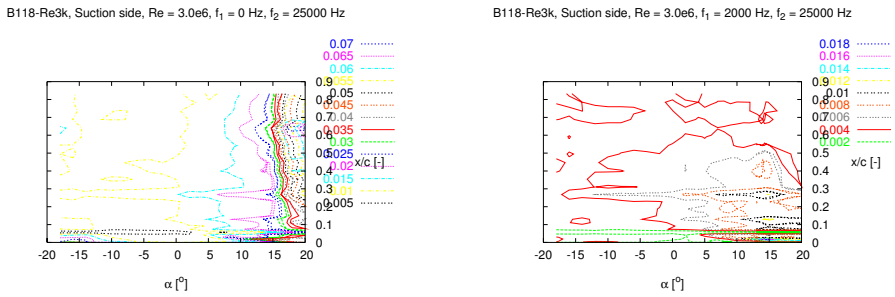

Figure 140: Contours of σ

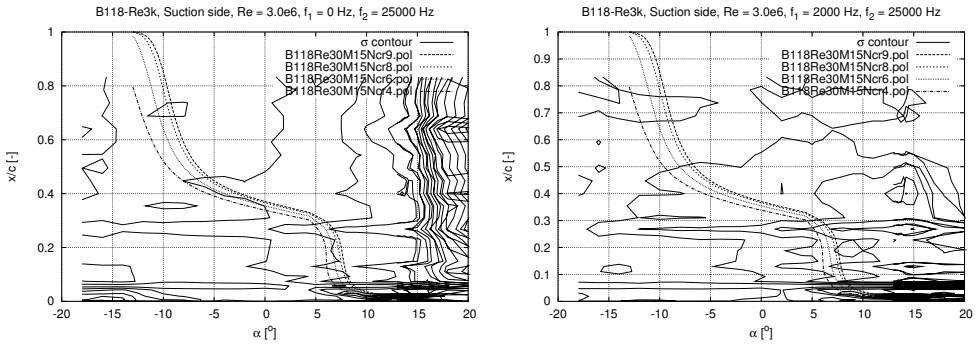

Figure 141: Contours of σ and XFoil data

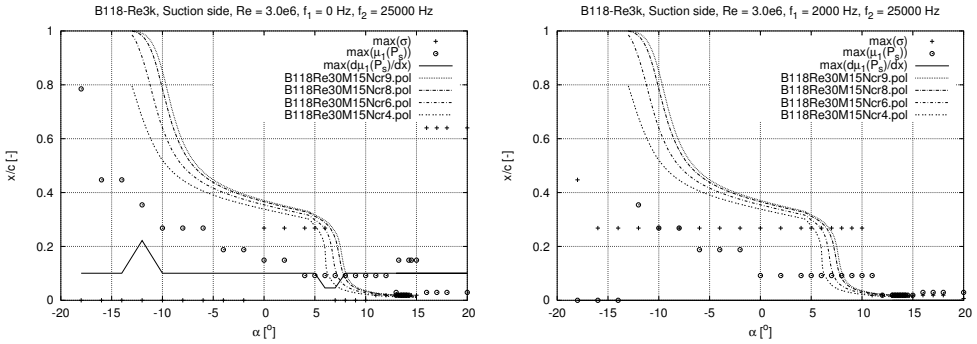

Figure 142: Transition detection

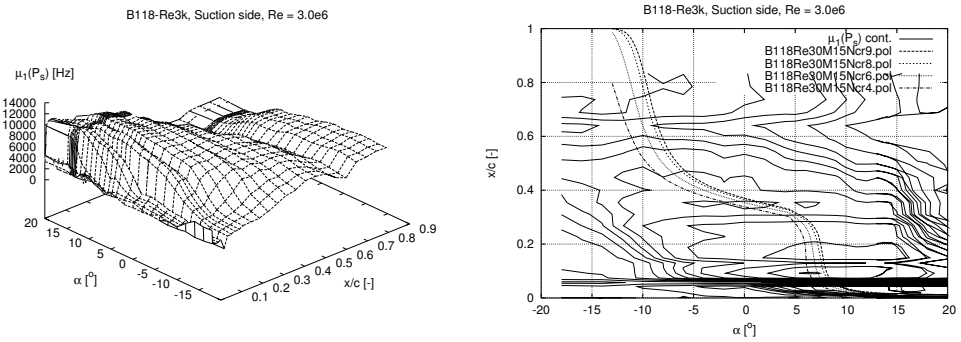

Figure 143: Fourier transform mean, $\mu_1(P_s)$

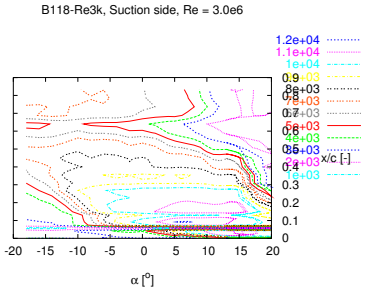

Figure 144: Contours of $\mu_1(P_s)$

```
B118-Re3k
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.1005     29983.3    7262.8
-16.00  0.1005     30510.8    7377.5
-14.00  0.1005     31201.9    7749.1
-12.00  0.2218     34740.1    8225.1
-10.00  0.1005     45825.9    8991.4
 -8.00  0.1005     70993.5    9555.9
 -6.00  0.1005     89650.8    9955.7
 -4.00  0.1005     93246.5   10238.4
 -2.00  0.1005     95027.3   10408.8
  0.00  0.1005    100281.7   10811.1
  2.00  0.1005    104496.9   11016.2
  4.00  0.1005    106342.3   11607.5
  5.00  0.1005    107208.2   11933.8
  6.00  0.0460    107926.6   12108.8
  7.00  0.0460    106633.2   12119.1
  8.00  0.1005    102657.9   11829.7
  9.00  0.1005    102904.2   11738.4
 10.00  0.1005    102064.4   11880.6
 11.00  0.1005    101386.8   11936.0
```

```
12.00  0.1005    100259.6   11869.7
13.00  0.1005    104353.5   11671.7
13.25  0.1005    105599.3   11760.7
13.50  0.1005    106570.4   11819.0
13.75  0.1005    107327.0   11801.9
14.00  0.1005    108140.7   11791.0
14.25  0.1005    107626.5   11702.3
15.00  0.1005    108278.5   11560.8
16.00  0.1005    100890.5   11352.9
17.00  0.1005     96439.6   11253.4
18.00  0.1005     90340.3   10924.2
20.00  0.1005     84472.8   10602.2
14.50  0.1005    108827.9   11612.7
14.25  0.1005    108379.2   11618.2
14.00  0.1005    107229.3   11630.4
13.75  0.1005    107791.2   11685.7
13.50  0.1005    107114.1   11659.8
13.25  0.1005    106431.6   11650.8
13.00  0.1005    104977.9   11634.2
```

4.25 Re3m Trip wire. Bump tape 0,1 2% 100x100

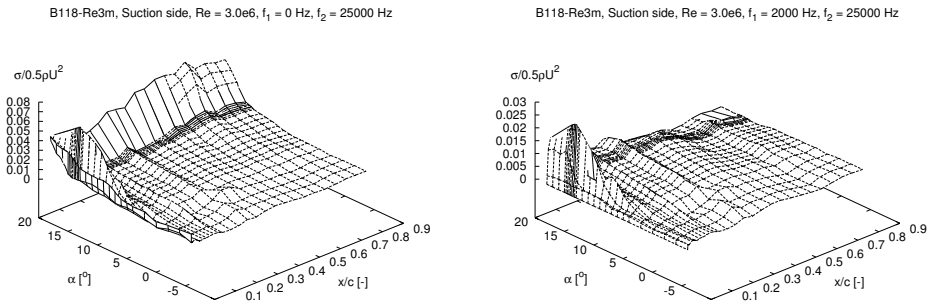

Figure 145: Pressure standard deviations, σ

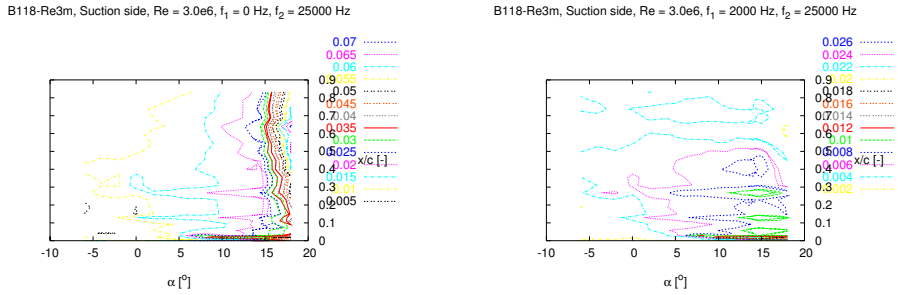

Figure 146: Contours of σ

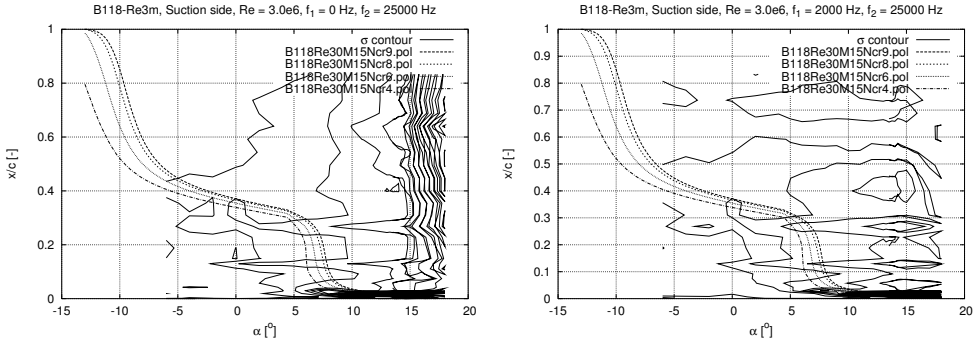

Figure 147: Contours of σ and XFoil data

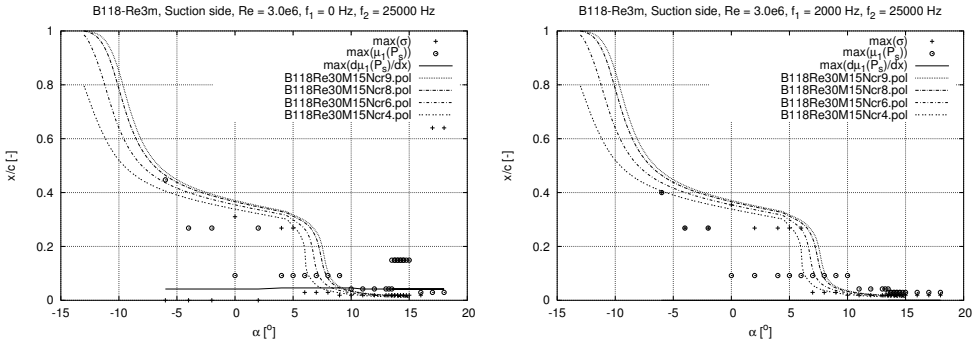

Figure 148: Transition detection

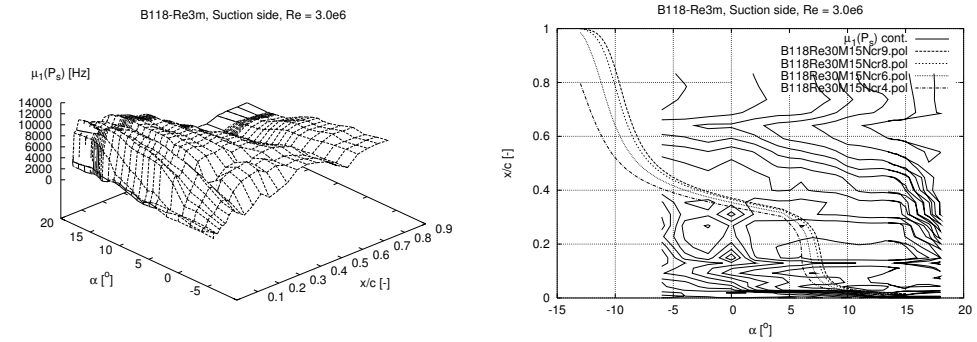

Figure 149: Fourier transform mean, $\mu_1(P_s)$

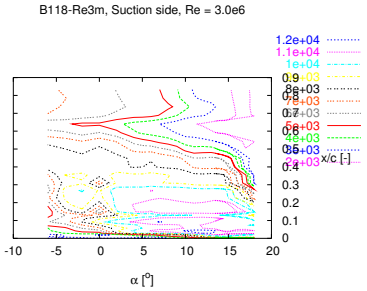

Figure 150: Contours of $\mu_1(P_s)$

```
B118-Re3m
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
 -6.00  0.0419     41179.5    8798.2
 -4.00  0.0419     44720.9    9484.8
 -2.00  0.0419     62674.0   10097.7
  0.00  0.0419     78668.8    9615.3
  2.00  0.0419     92600.2   10669.6
  4.00  0.0460     91031.1   11130.0
  5.00  0.0460     98532.8   11563.4
  6.00  0.0460    104272.8   11857.2
  7.00  0.0460    104774.6   12066.1
  8.00  0.0460     95453.8   11826.0
  9.00  0.0460     89401.0   11770.7
 10.00  0.0460     85212.9   12139.7
 11.00  0.0419     87892.4   12318.0
 12.00  0.0419     86716.7   12410.3
 13.00  0.0419     78719.9   12275.6
 13.25  0.0419     76351.8   12152.6
 13.50  0.0419     72569.2   12040.7
 13.75  0.0419     70305.1   11801.7
 14.00  0.0419     68524.5   11796.5
```

```
14.25  0.0419     67823.7   11693.2
14.50  0.0419     65784.6   11688.7
14.75  0.0419     64440.8   11681.5
15.00  0.0419     64110.6   11693.8
16.00  0.0419     69449.1   11690.7
17.00  0.0419     69269.0   11766.7
18.00  0.0419     65579.0   11449.1
14.50  0.0419     65820.7   11723.8
14.25  0.0419     66901.6   11761.6
14.00  0.0419     69797.3   11787.3
13.75  0.0419     70557.3   11761.7
13.50  0.0419     72563.1   11797.1
```

4.26 Re4a Clean -

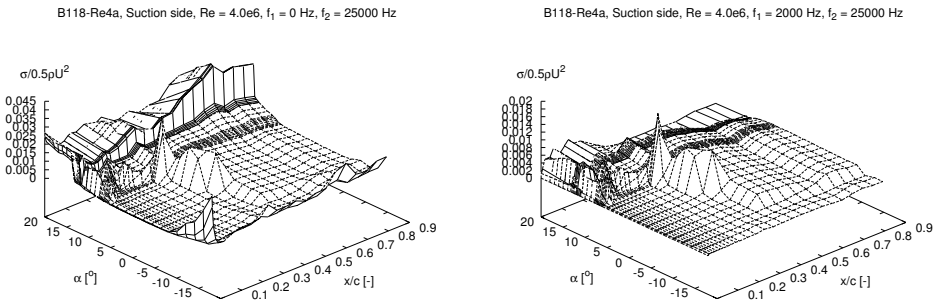

Figure 151: Pressure standard deviations, σ

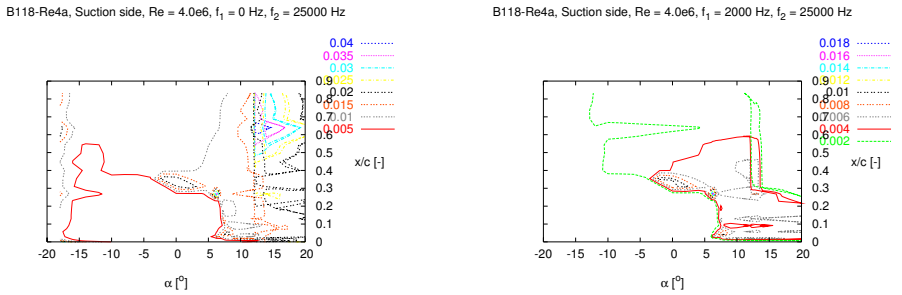

Figure 152: Contours of σ

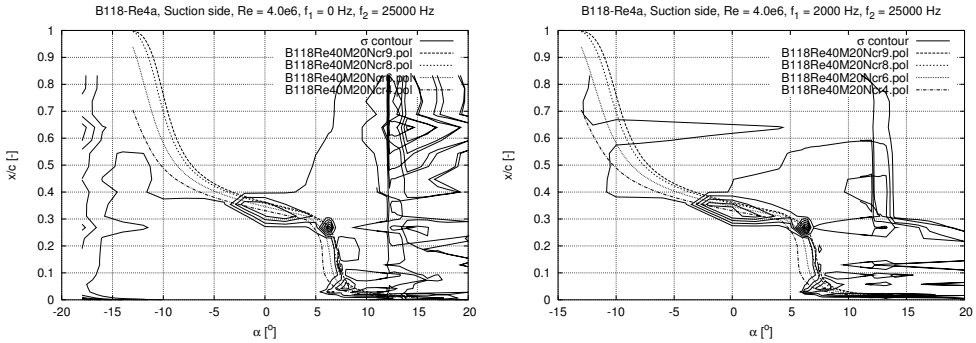

Figure 153: Contours of σ and XFoil data

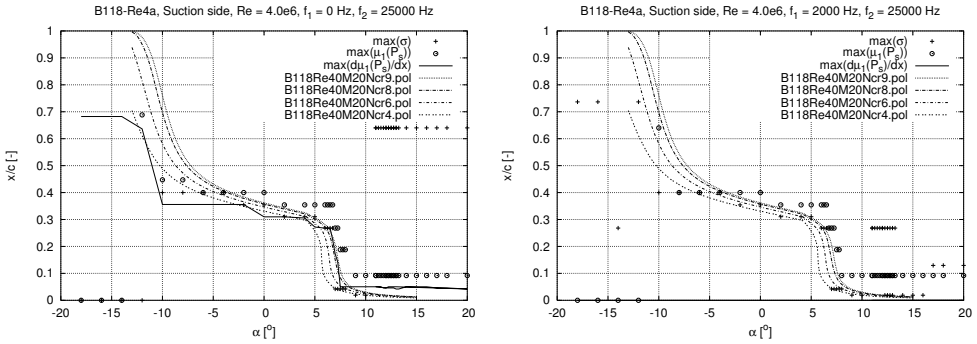

Figure 154: Transition detection

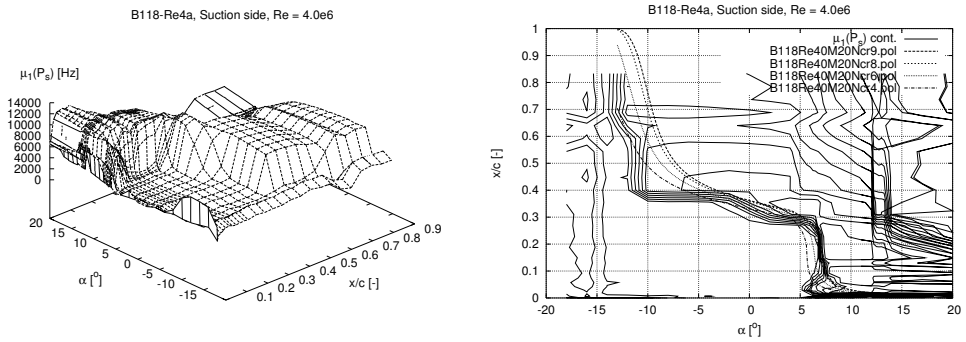

Figure 155: Fourier transform mean, $\mu_1(P_s)$

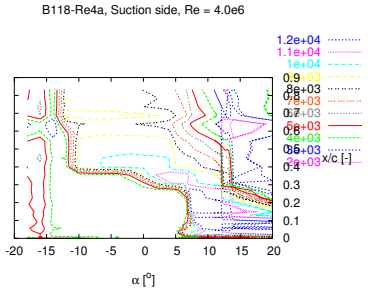

Figure 156: Contours of $\mu_1(P_s)$

```
B118-Re4a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.6823     28998.9    5530.3
-16.00  0.6823     28816.0    8304.1
-14.00  0.6823     17705.6    8645.9
-12.00  0.6362     53508.6    9554.3
-10.00  0.3558     72495.8    9650.2
 -8.00  0.3558     72408.6    9884.4
 -6.00  0.3558     76146.0   10085.2
 -4.00  0.3558     75515.7   10274.4
 -2.00  0.3558     77340.0   10419.8
  0.00  0.3098     65761.4   10150.3
  2.00  0.3098     87292.7   11039.9
  4.00  0.3056     92374.7   11598.2
  5.00  0.2721     91791.0   11698.1
  6.00  0.2679     91591.6   11750.7
  6.25  0.2679     89677.8   11737.0
  6.50  0.2679     83481.4   11713.8
  6.75  0.2260     85902.8   11637.0
  7.00  0.1716     49655.8   12134.8
  7.25  0.1423     58515.5   12460.8
```

7.50	0.0502	53867.1	12477.4
7.75	0.0502	79164.8	12529.8
8.00	0.0502	83655.1	12515.7
9.00	0.0502	86333.7	12776.0
10.00	0.0502	85136.0	12867.8
11.00	0.0502	83139.9	12907.1
12.00	0.0460	51592.3	12912.4
12.25	0.0460	53155.6	12896.9
12.50	0.0460	54575.1	12869.7
12.75	0.0460	52940.7	12874.3
13.00	0.0419	49381.9	12924.4
13.25	0.0419	49515.7	12930.0
14.00	0.0502	74968.4	12416.3
15.00	0.0502	74566.4	12339.7
16.00	0.0502	73426.4	12298.9
17.00	0.0460	72152.2	12345.7
18.00	0.0460	66307.3	12253.3
20.00	0.0419	56411.4	12107.5
13.00	0.0502	74783.3	12295.0
12.75	0.0502	75167.3	12306.8
12.50	0.0502	75254.8	12305.6
12.25	0.0502	75665.6	12316.8
12.00	0.0460	52170.7	12879.7
11.75	0.0460	52771.3	12883.8
11.50	0.0502	67535.6	12902.1
11.25	0.0502	76676.6	12904.1
11.00	0.0502	82079.4	12914.7

4.27 Re5a Clean -

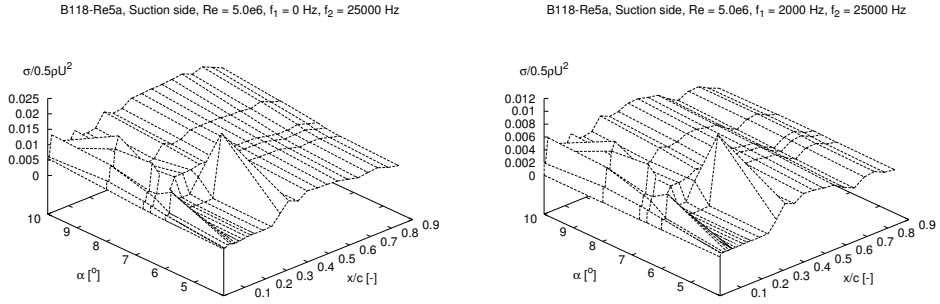

Figure 157: Pressure standard deviations, σ

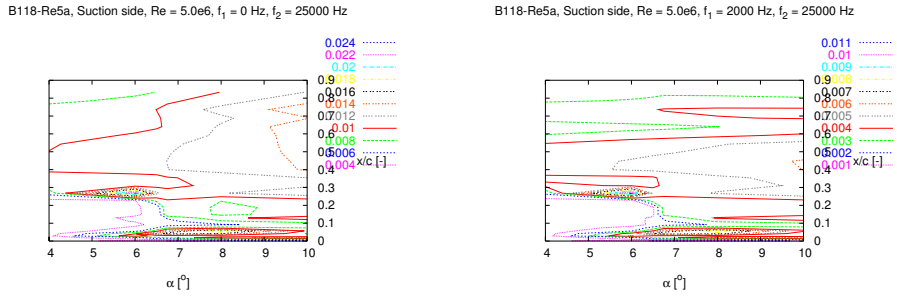

Figure 158: Contours of σ

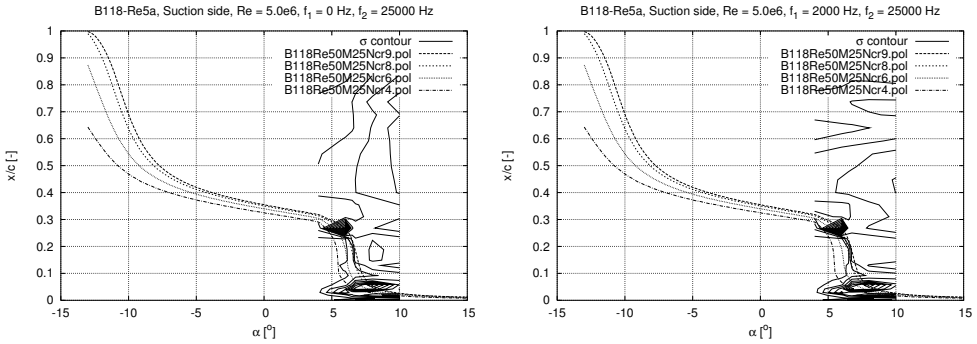

Figure 159: Contours of σ and XFoil data

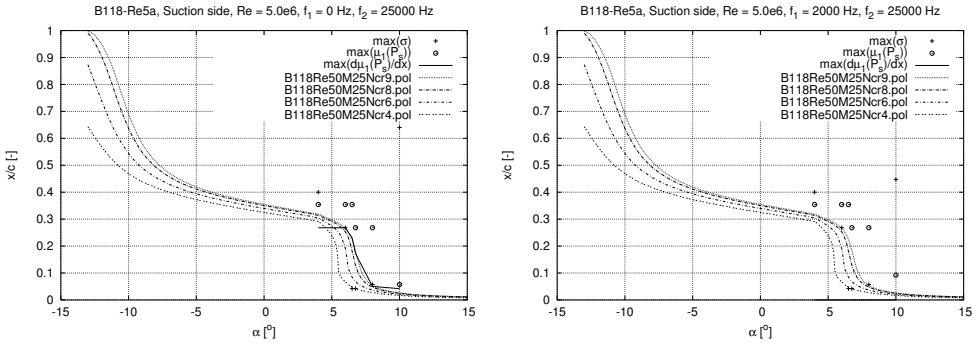

Figure 160: Transition detection

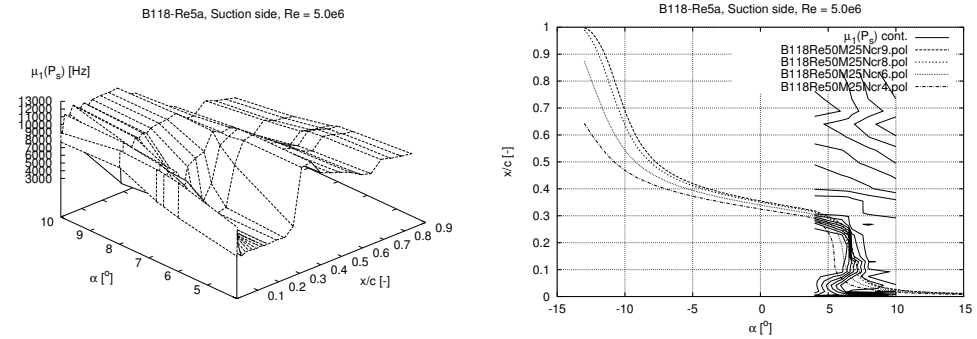

Figure 161: Fourier transform mean, $\mu_1(P_s)$

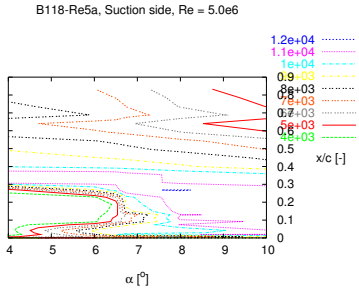

Figure 162: Contours of $\mu_1(P_s)$

```
B118-Re5a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions
```

alpha	xtr*	d(mu1)/dx*	max(mu1)
-18.00	0.6446	18845.8	6441.4
-16.00	0.6446	19238.9	6886.2
-14.00	0.6823	60100.0	9610.8
-12.00	0.3935	65844.1	10038.6
-10.00	0.3558	77384.6	10183.3
-8.00	0.3558	78796.7	10564.7
-6.00	0.3558	82830.0	10886.9
-4.00	0.3558	81384.3	11092.5
-2.00	0.3516	74624.7	11282.9
0.00	0.3098	90798.4	11492.4
2.00	0.3098	96361.4	11864.5
4.00	0.2679	93719.6	11817.3
5.00	0.2679	94731.9	11842.8
6.00	0.2679	89233.0	11822.7
6.25	0.2637	81980.0	11850.1
6.50	0.2302	74365.3	11733.7
6.75	0.1716	40371.7	11947.0
7.00	0.1716	45824.1	12101.5
7.25	0.0419	44659.5	12109.2
7.50	0.0502	41967.8	12092.8
7.75	0.0502	46847.1	12050.5
8.00	0.0502	48455.3	12028.5
9.00	0.0502	57311.5	11917.0
10.00	0.0419	39125.0	11889.5
11.00	0.0419	37115.9	11934.8
12.00	0.0419	35742.4	11958.0
12.25	0.0419	35374.2	11967.0
12.50	0.0419	36023.8	11945.4
12.75	0.0419	35756.9	11964.2
13.00	0.0419	33686.4	12024.1
13.25	0.0419	34015.7	12028.5
14.00	0.0502	53032.0	13566.0
15.00	0.0419	48263.4	11478.4
16.00	0.0419	50981.2	11533.7
17.00	0.0419	49801.0	11559.8
18.00	0.0419	49393.4	11568.7
20.00	0.0419	50978.1	11591.0
13.00	0.0502	51455.1	11320.8
12.75	0.0502	50136.1	11325.6
12.50	0.0502	42761.2	11389.6
12.25	0.0419	31870.0	12004.5
12.00	0.0419	35217.3	11948.4
11.75	0.0419	35183.9	11941.2
11.50	0.0419	35840.2	11958.3
11.25	0.0419	35891.9	11937.5
11.00	0.0419	36816.4	11953.1

4.28 Re6a Clean -

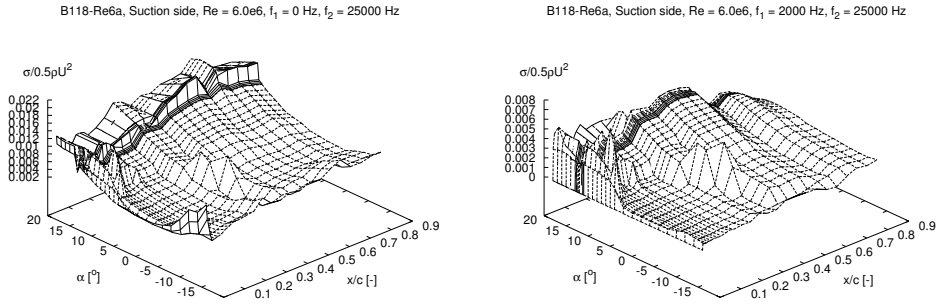

Figure 163: Pressure standard deviations, σ

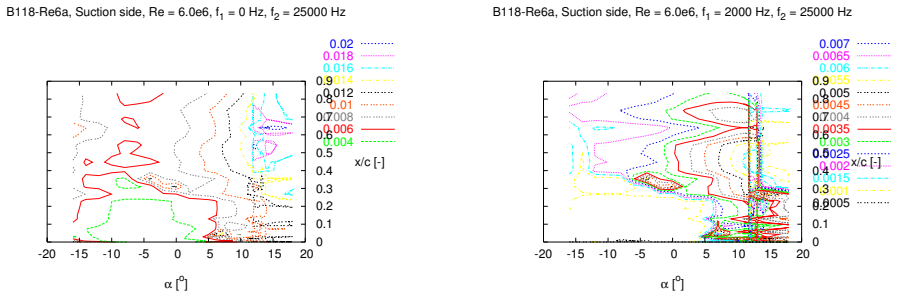

Figure 164: Contours of σ

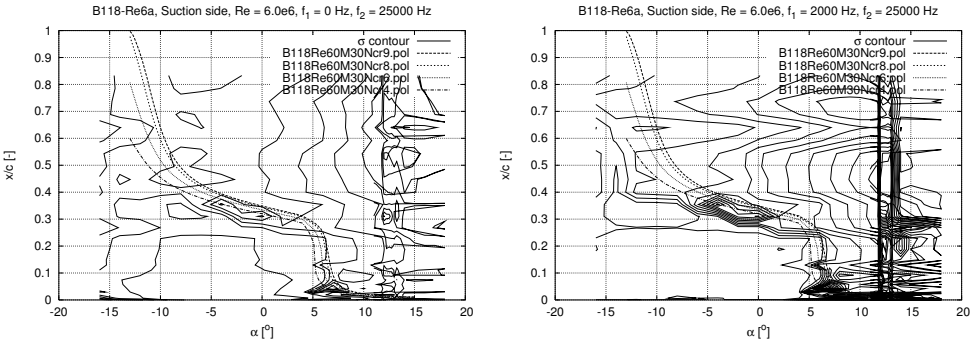

Figure 165: Contours of σ and XFoil data

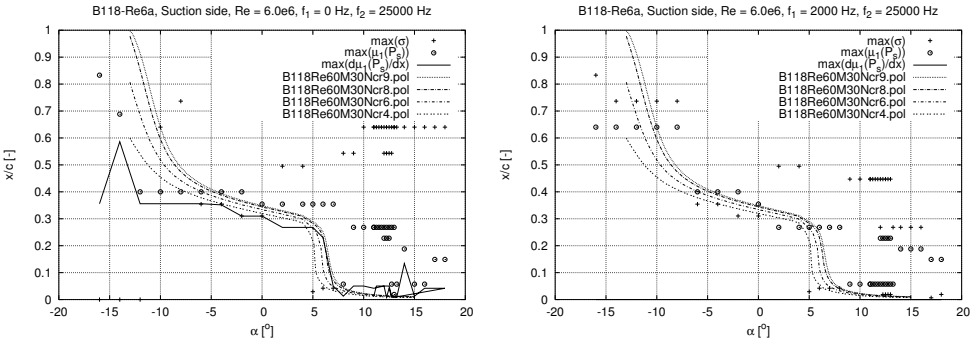

Figure 166: Transition detection

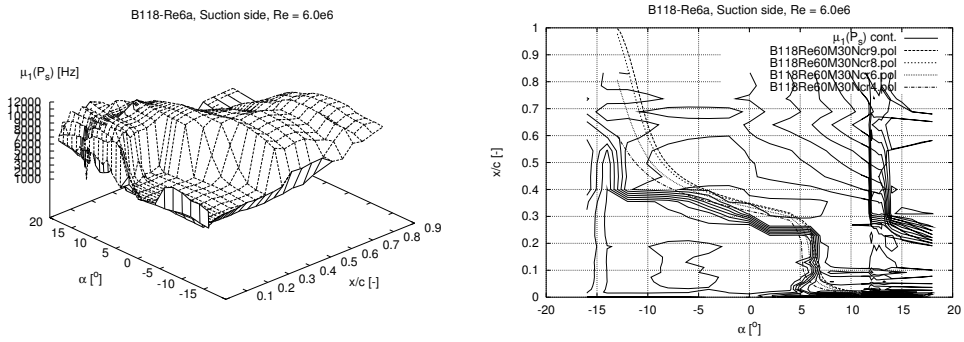

Figure 167: Fourier transform mean, $\mu_1(P_s)$

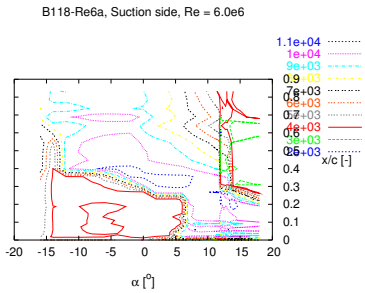

Figure 168: Contours of $\mu_1(P_s)$

```
B118-Re6a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.3558     20460.6     8898.5
-14.00  0.5860     38399.5     9913.8
-12.00  0.3558     70484.5     9878.0
-10.00  0.3558     75163.6    10376.7
 -8.00  0.3558     78466.3    10834.5
 -6.00  0.3558     78183.6    11116.9
 -4.00  0.3516     73825.2    11236.3
 -2.00  0.3098     83119.5    11233.9
  0.00  0.3098     83394.5    11100.1
  2.00  0.2679     84222.3    11144.0
  4.00  0.2679     85439.0    11176.9
  5.00  0.2679     86367.3    11182.2
  6.00  0.2302     81436.8    11191.2
  7.00  0.0502     41297.3    11154.6
  8.00  0.0126     32342.9    11042.5
  9.00  0.0502     35769.3    10989.8
 10.00  0.0502     30088.2    10997.7
 11.00  0.0419     20542.6    11021.3
 12.00  0.0502     34206.5    11044.4
 12.25  0.0502     32645.0    11084.9
 12.50  0.0502     31258.9    11078.9
 12.75  0.0126     31260.1    11074.1
 13.00  0.0126     29498.6    11118.7
 13.25  0.0084     32522.7    11085.6
 14.00  0.1339     28854.7    11671.3
 15.00  0.0126     26760.9    10581.0
 16.00  0.0419     26858.8    10607.5
 17.00  0.0419     27792.7    10669.4
 18.00  0.0419     30078.3    10819.8
 13.00  0.0084     26671.3    10418.5
 12.75  0.0084     27087.7    10352.2
 12.50  0.0419     27703.7    10626.7
 12.25  0.0084     28361.1    10458.0
 12.00  0.0502     42054.1    11520.3
 11.75  0.0502     34010.9    10999.4
 11.50  0.0502     33869.4    11005.3
 11.25  0.0502     32393.3    11019.4
 11.00  0.0126     20510.6    10997.3
```

4.29 Re6b ZZ90 x/c=5% suc. x/c=10% press. -

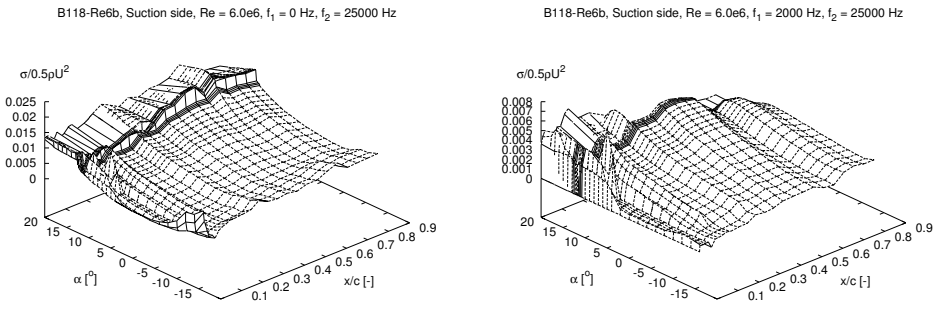

Figure 169: Pressure standard deviations, σ

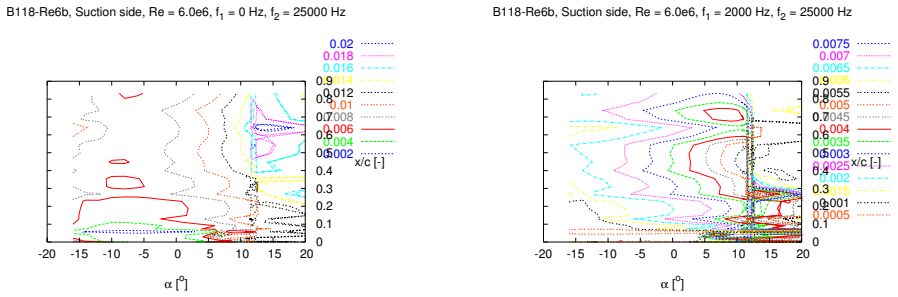

Figure 170: Contours of σ

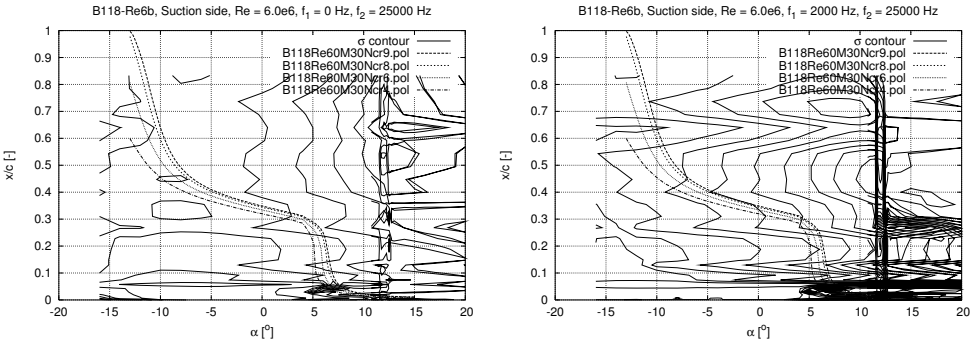

Figure 171: Contours of σ and XFoil data

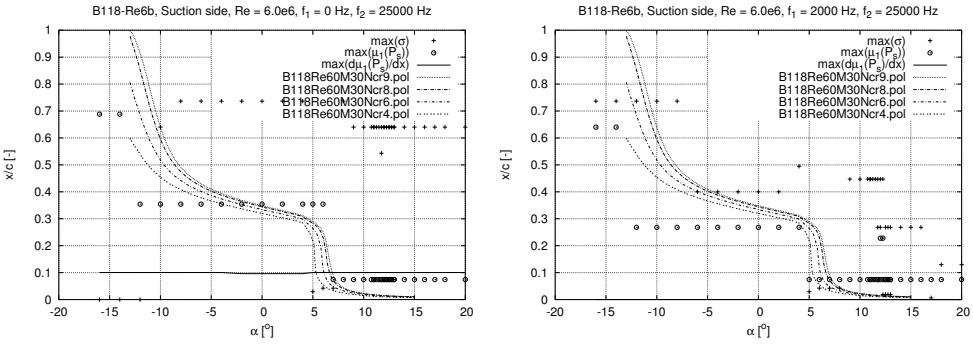

Figure 172: Transition detection

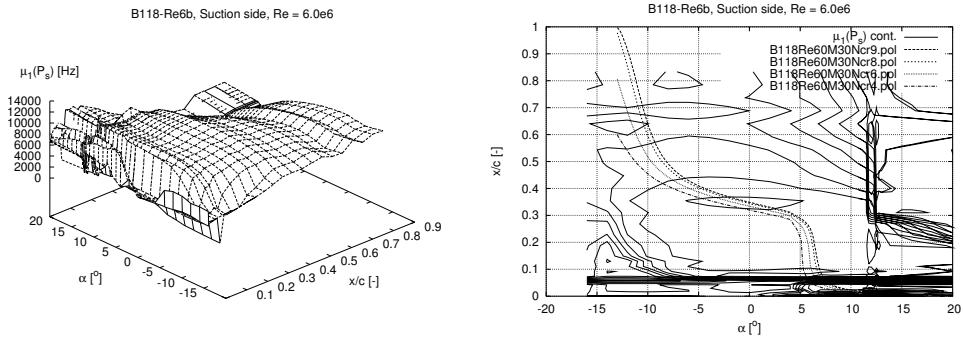

Figure 173: Fourier transform mean, $\mu_1(P_s)$

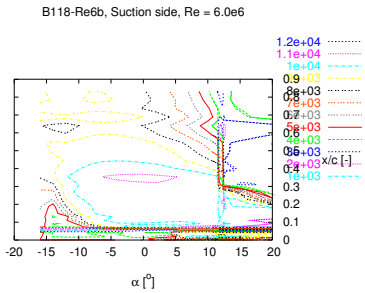

Figure 174: Contours of $\mu_1(P_s)$

```
B118-Re6b
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.1005     54368.7    9619.6
-14.00  0.1005     36372.4    9471.6
-12.00  0.1005     60162.9    9943.8
-10.00  0.1005     91319.2   10416.8
 -8.00  0.1005     97994.3   10786.1
 -6.00  0.1005     98141.0   11027.4
 -4.00  0.1005     96868.3   11128.3
 -2.00  0.0963     89718.0   11173.7
  0.00  0.0963     84849.0   11184.0
  2.00  0.0963     82442.8   11149.2
  4.00  0.0963     82493.3   11064.9
  5.00  0.1005     78166.2   11012.8
  6.00  0.1005     72407.0   10965.6
  7.00  0.1005     72954.1   11601.0
  8.00  0.1005     68802.9   11332.1
  9.00  0.1005     72454.9   11345.6
 10.00  0.1005     73964.2   11409.7
 11.00  0.1005     75152.4   11418.6
 11.75  0.1005     76169.2   11451.6
 12.00  0.1005     76072.6   11435.0
 12.25  0.1005     76303.1   11438.6
 12.50  0.1005     80633.7   12781.6
 12.75  0.1005     78268.8   10921.3
 13.00  0.1005     78909.7   10905.7
 14.00  0.1005     80087.4   11024.6
 15.00  0.1005     81741.7   11087.4
 16.00  0.1005     82857.3   11159.1
 17.00  0.1005     84778.2   11213.1
 18.00  0.1005     85696.2   11264.0
 20.00  0.1005     88185.0   11326.3
 13.00  0.1005     78399.9   10927.4
 12.75  0.1005     78121.1   10864.8
 12.50  0.1005     77822.1   10891.5
 12.25  0.1005     77104.6   10834.9
 12.00  0.1005     73647.6   10488.4
 11.75  0.1005     73357.9   10509.5
 11.50  0.1005     75301.3   11384.2
 11.25  0.1005     75420.3   11438.9
 11.00  0.1005     74928.2   11406.6
 10.75  0.1005     75091.6   11445.8
```

4.30 Re6c LM standard LER. ZZ 2% -

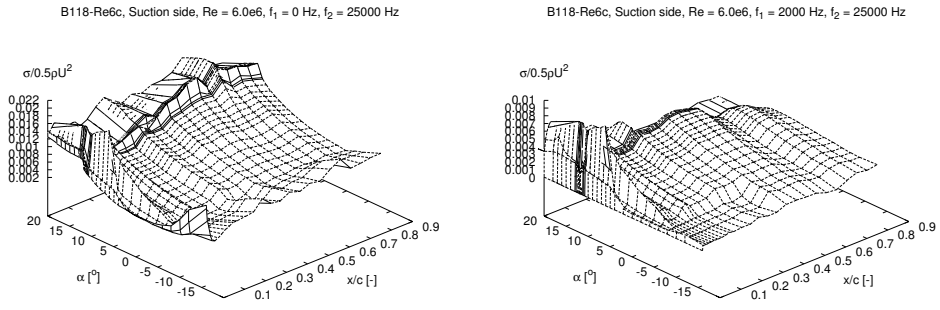

Figure 175: Pressure standard deviations, σ

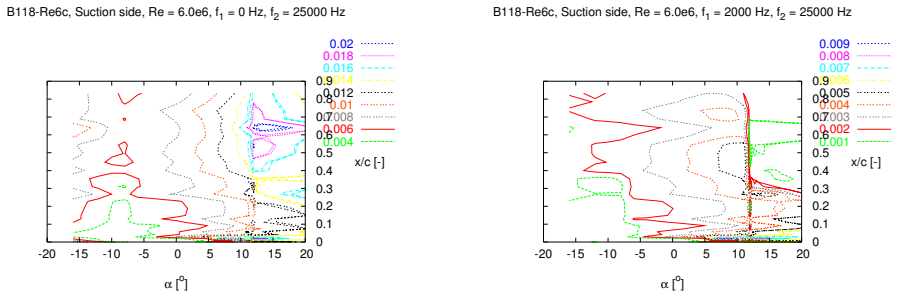

Figure 176: Contours of σ

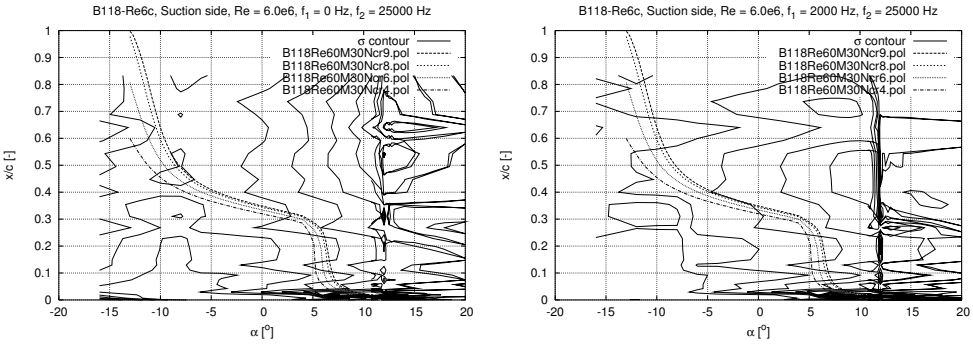

Figure 177: Contours of σ and XFoil data

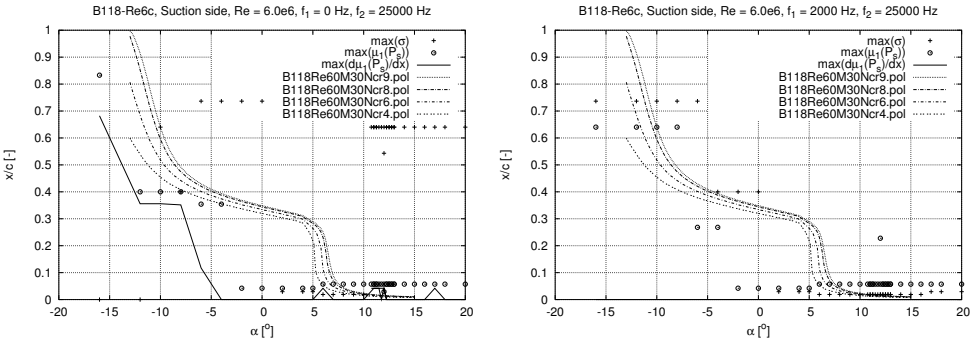

Figure 178: Transition detection

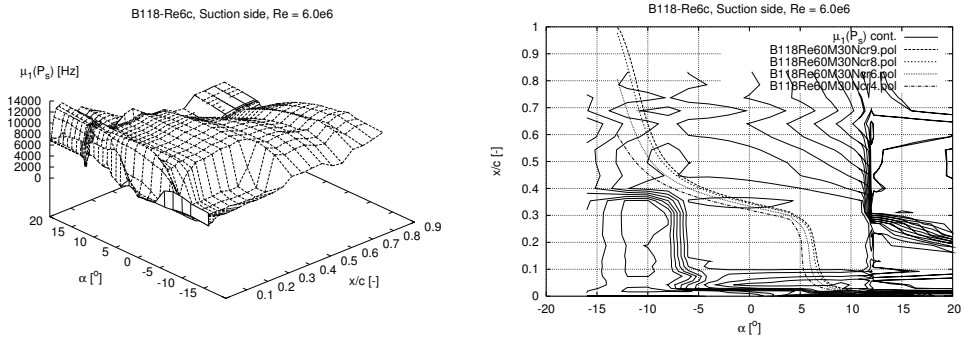

Figure 179: Fourier transform mean, $\mu_1(P_s)$

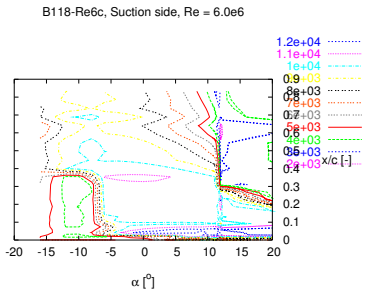

Figure 180: Contours of $\mu_1(P_s)$

```
B118-Re6c
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.6823     19430.0    8869.1
-12.00  0.3558     71318.2    9964.9
-10.00  0.3558     75953.5   10454.8
 -8.00  0.3516     74915.7   10841.4
 -6.00  0.1172     53086.7   11033.1
 -4.00  0.0000     67233.0   11112.5
 -2.00  0.0000     81439.6   11889.9
  0.00  0.0000     83221.0   12400.5
  2.00  0.0000     72304.7   12396.3
  4.00  0.0000     65836.1   12280.9
  5.00  0.0000     62006.7   12223.9
  6.00  0.0419     50358.3   12275.1
  7.00  0.0000     38711.9   12338.1
  8.00  0.0000     40186.0   12270.0
  9.00  0.0000     36244.9   12150.4
 10.00  0.0000     34740.7   12405.1
 11.00  0.0419     30023.4   12466.3
 11.25  0.0419     30711.6   12483.8
 11.50  0.0419     31776.7   12502.6
 11.75  0.0000     36572.9   12515.4
 12.00  0.0419     53504.3   12458.2
 12.25  0.0000     37134.5   12061.1
 12.50  0.0000     36999.2   12076.5
 12.75  0.0000     37377.1   12101.9
 13.00  0.0000     37095.8   12145.6
 14.00  0.0000     38049.2   12293.7
 15.00  0.0000     37227.1   12346.0
 16.00  0.0000     35714.2   12435.1
 17.00  0.0419     36289.7   12519.1
 18.00  0.0000     40249.5   12652.0
 20.00  0.0000     45692.0   12790.3
 13.00  0.0000     36906.2   12121.7
 12.75  0.0000     36984.4   12095.4
 12.50  0.0000     37202.0   12073.2
 12.25  0.0000     37048.5   12023.3
 12.00  0.0419     44706.2   11878.6
 11.25  0.0419     32744.6   12392.2
 11.00  0.0419     30183.3   12471.4
 10.75  0.0419     29848.8   12482.5
```

4.31 Re6d Trip wire. Bump tape 2% -

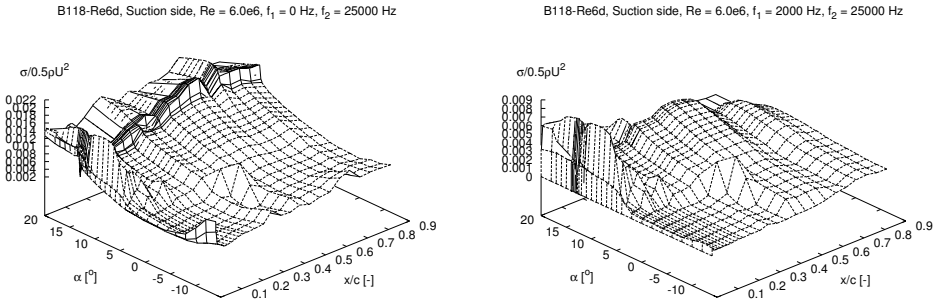

Figure 181: Pressure standard deviations, σ

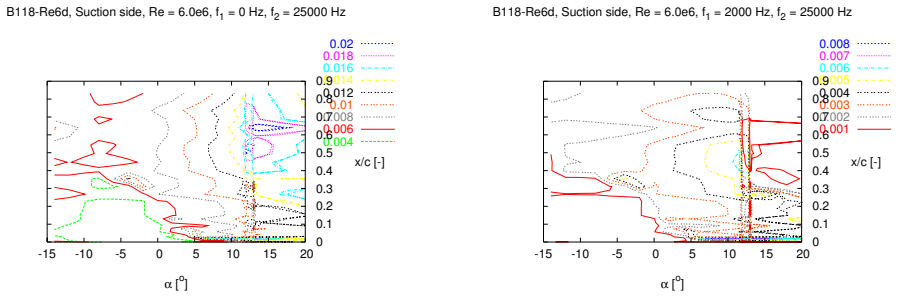

Figure 182: Contours of σ

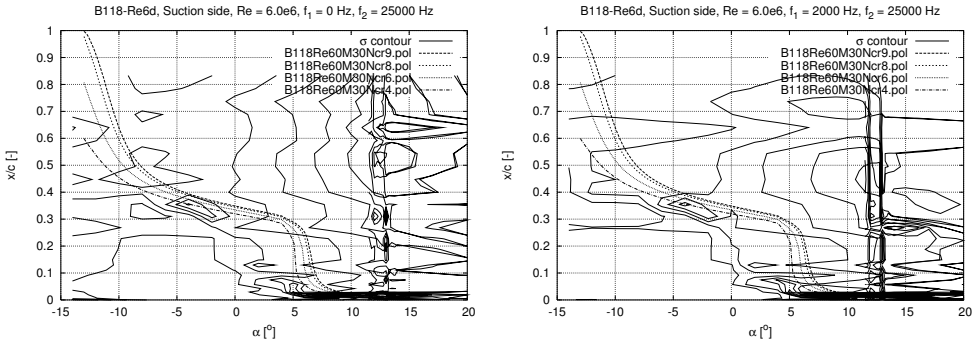

Figure 183: Contours of σ and XFoil data

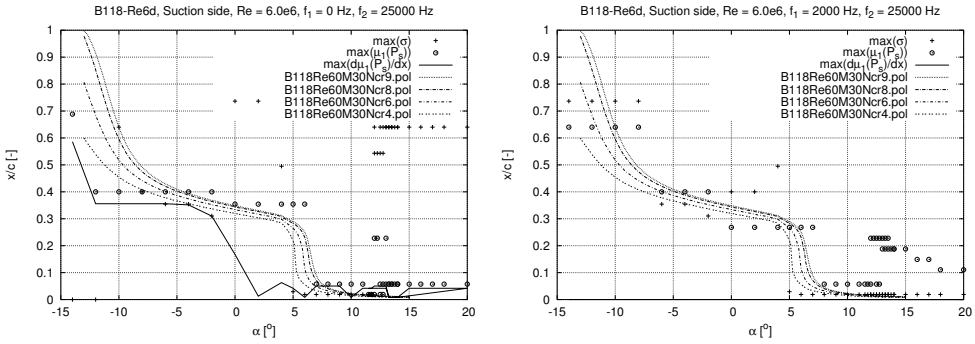

Figure 184: Transition detection

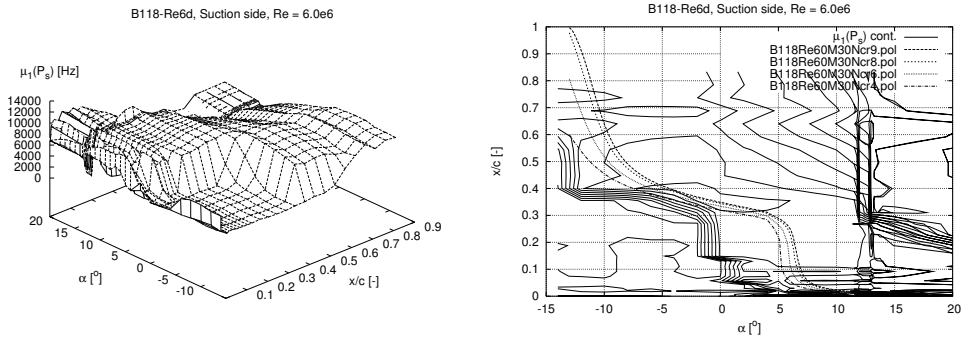

Figure 185: Fourier transform mean, $\mu_1(P_s)$

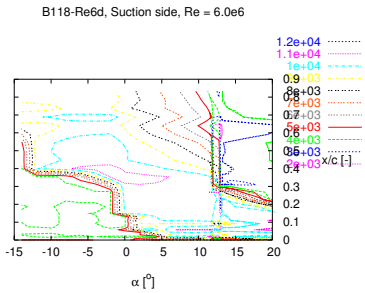

Figure 186: Contours of $\mu_1(P_s)$

```
B118-Re6d
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-14.00  0.5860     40037.0     9894.0
-12.00  0.3558     71018.1     9933.2
-10.00  0.3558     75923.6    10393.5
 -8.00  0.3558     78376.4    10882.0
 -6.00  0.3558     79193.3    11195.4
 -4.00  0.3516     74857.4    11378.2
 -2.00  0.3098     83176.7    11456.6
  0.00  0.1674     74349.1    11216.0
  2.00  0.0126     76914.4    11209.6
  4.00  0.0628     61930.4    11107.7
  5.00  0.0419     45246.1    11073.2
  6.00  0.0084     27961.4    10996.9
  7.00  0.0502     30614.3    11021.7
  8.00  0.0502     35940.3    11058.8
  9.00  0.0502     35928.2    11085.8
 10.00  0.0084     27596.6    11053.3
 11.00  0.0419     23759.9    11015.8
 12.00  0.0419     23722.4    11695.5
 12.50  0.0419     26974.5    11629.7
 12.75  0.0419     28171.5    11528.0
 13.00  0.0419     48665.2    12477.1
 13.25  0.0084     29693.0    10714.5
 13.50  0.0084     28793.3    10707.6
 14.00  0.0084     27944.3    10684.0
 15.00  0.0419     27134.7    10658.9
 16.00  0.0419     30111.9    10805.0
 17.00  0.0419     32506.5    10922.3
 18.00  0.0419     35363.2    10990.0
 20.00  0.0419     42369.6    11232.8
 14.00  0.0084     27098.6    10657.7
 13.75  0.0084     28206.2    10628.9
 13.50  0.0084     28971.3    10679.6
 13.25  0.0084     29151.5    10683.1
 13.00  0.0502     39271.8    10252.1
 12.75  0.0502     39263.5    10234.9
 12.50  0.0502     40116.9    10292.7
 12.25  0.0502     39537.1    10344.5
 12.00  0.0502     41533.4    10907.0
 11.75  0.0419     26407.0    11311.2
 11.50  0.0419     24387.8    11417.1
```

4.32 Re6f Clean 200x200

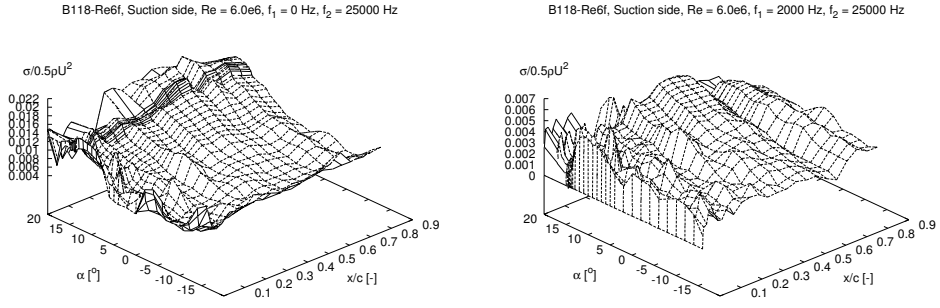

Figure 187: Pressure standard deviations, σ

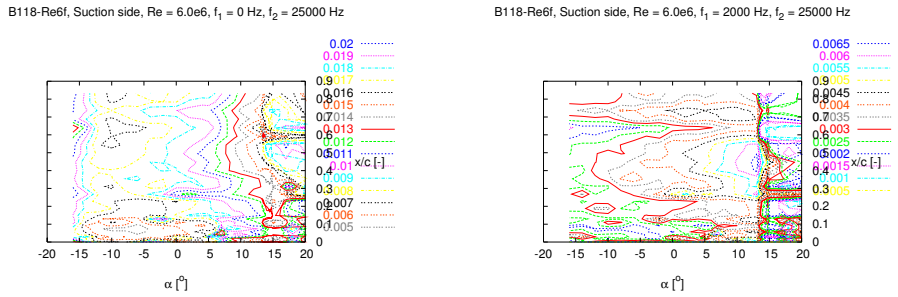

Figure 188: Contours of σ

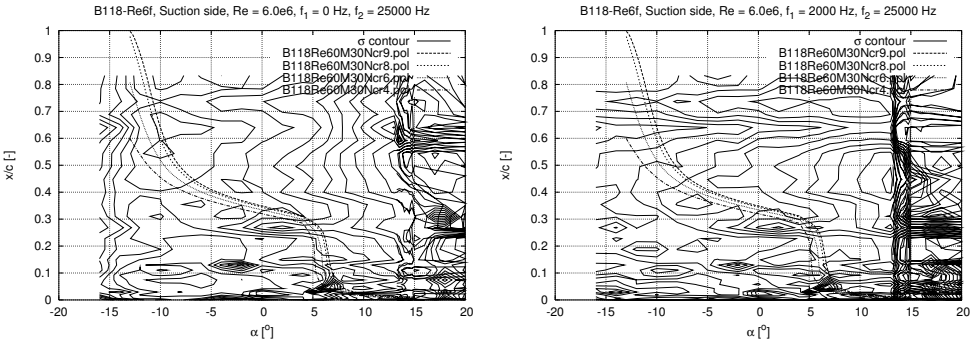

Figure 189: Contours of σ and XFoil data

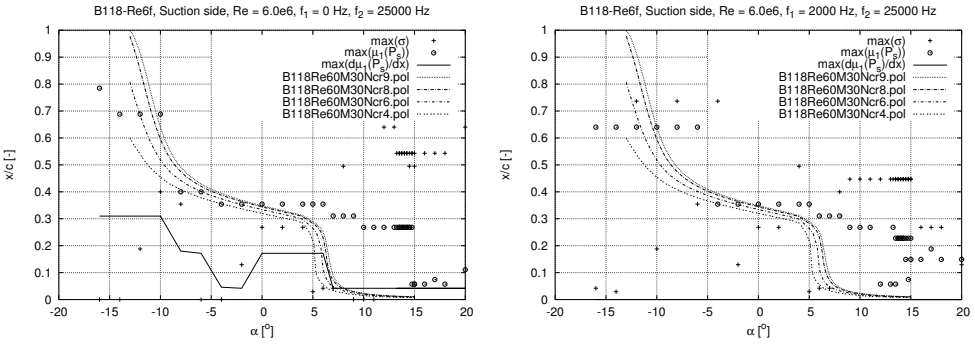

Figure 190: Transition detection

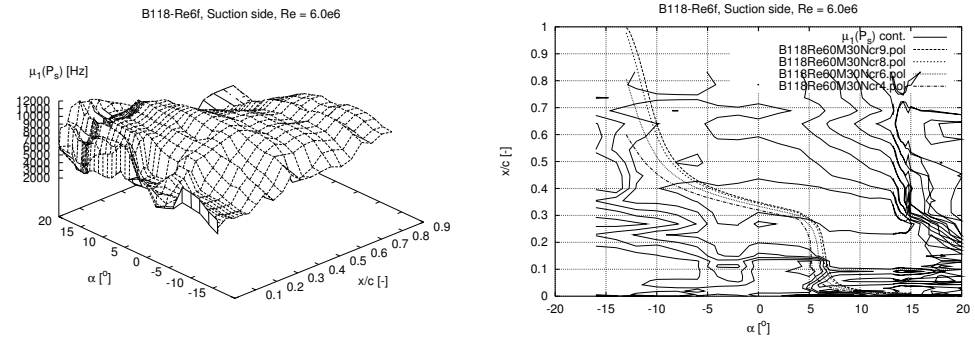

Figure 191: Fourier transform mean, $\mu_1(P_s)$

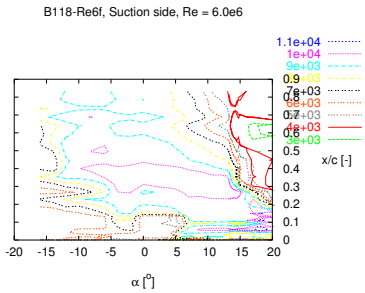

Figure 192: Contours of $\mu_1(P_s)$

B118-Re6f
alpha [degrees] angle of attack
xtr* [-] transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx* [Hz/-] d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1) [Hz] max mu1 of all chordwise positions

alpha	xtr*	d(mu1)/dx*	max(mu1)
-16.00	0.3098	26284.4	8639.0
-14.00	0.3098	36026.1	9160.2
-12.00	0.3098	40559.2	9671.4
-10.00	0.3098	35512.7	9989.7
-8.00	0.1800	34962.3	10255.5
-6.00	0.1716	35229.4	10391.6
-4.00	0.0460	29063.4	10645.6
-2.00	0.0419	37248.1	10743.3
0.00	0.1716	47007.1	10769.5
2.00	0.1716	49673.3	10846.9
4.00	0.1716	51980.6	10872.3
5.00	0.1716	53908.2	10904.1
6.00	0.1716	47642.4	10849.6
7.00	0.0419	22637.0	10814.8
8.00	0.0419	35042.0	10748.3
9.00	0.0419	37081.8	10667.0
10.00	0.0419	38380.0	10494.5
11.00	0.0419	38227.1	10600.3
12.00	0.0419	38815.7	10665.2
13.00	0.0419	43628.6	10775.0
13.50	0.0419	44122.4	10697.7
13.75	0.0419	43462.8	10592.0
14.00	0.0419	42888.6	10554.4
14.25	0.0419	44648.8	10555.0
14.50	0.0419	47022.8	10519.9
14.75	0.0419	44740.8	10596.8
15.00	0.0419	45253.8	10300.8
16.00	0.0419	46982.3	10320.7
17.00	0.0419	35412.1	10471.3
18.00	0.0419	49018.6	11942.5
20.00	0.0419	41232.0	10618.6
15.00	0.0419	46233.3	10223.6
14.75	0.0419	46979.5	10460.4
14.50	0.0419	45078.9	10425.2
14.25	0.0419	44599.2	10543.2
14.00	0.0419	43432.8	10555.7
13.75	0.0419	44076.5	10649.6
13.50	0.0419	43668.5	10633.8
13.25	0.0419	45367.8	10759.5

4.33 Re6g ZZ90 x/c=5% suc. x/c=10% press. 200x200

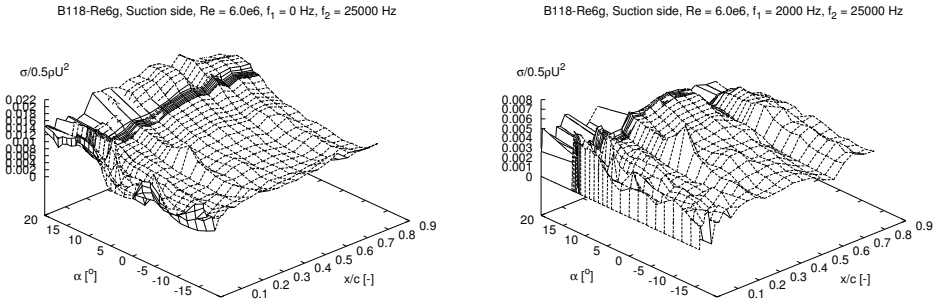

Figure 193: Pressure standard deviations, σ

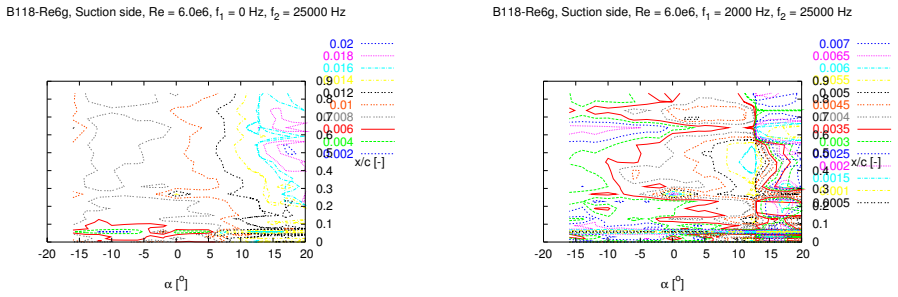

Figure 194: Contours of σ

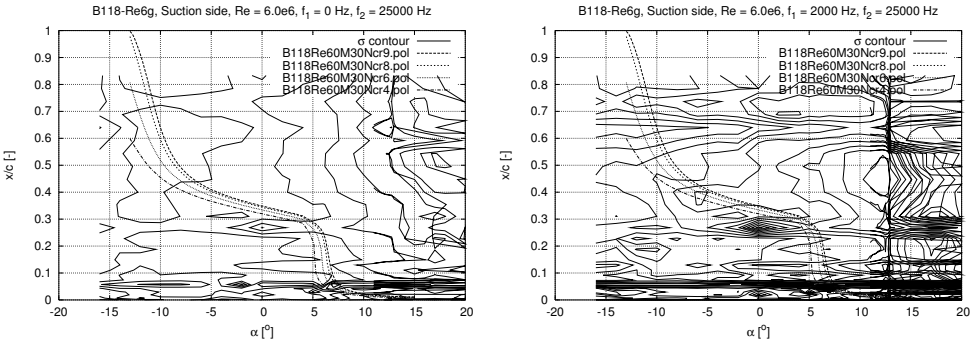

Figure 195: Contours of σ and XFoil data

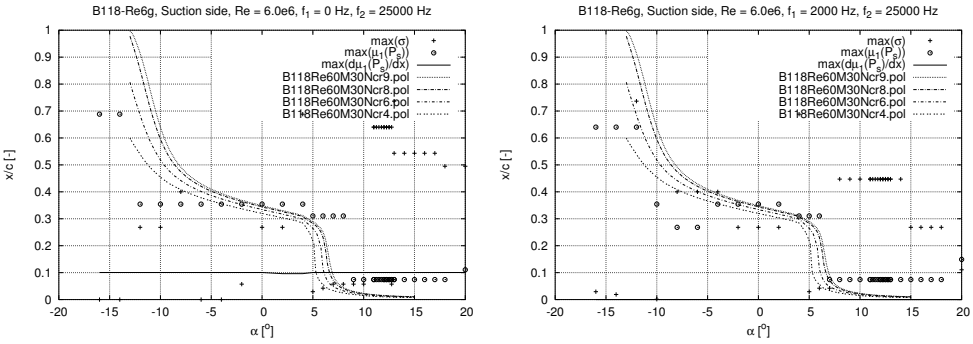

Figure 196: Transition detection

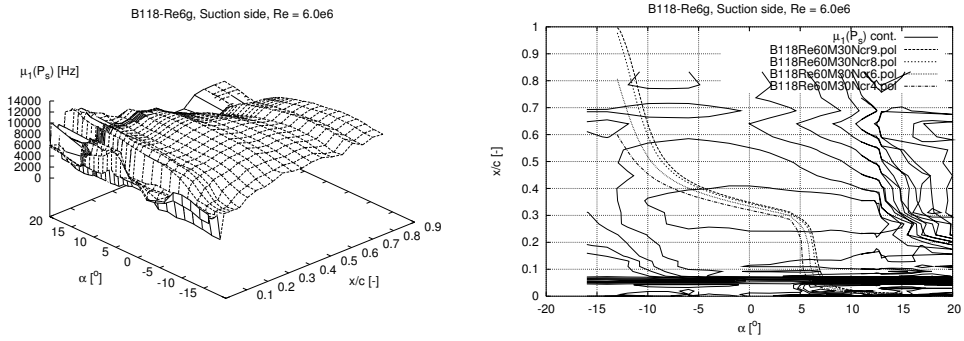

Figure 197: Fourier transform mean, $\mu_1(P_s)$

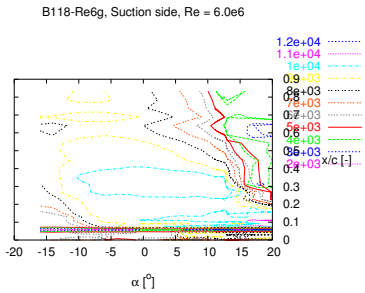

Figure 198: Contours of $\mu_1(P_s)$

```
B118-Re6g
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.1005     45745.3    9099.5
-14.00  0.1005     49790.6    9116.3
-12.00  0.1005     58146.3    9370.8
-10.00  0.1005     72041.0   10114.3
 -8.00  0.1005     78471.0   10362.1
 -6.00  0.1005     84760.4   10572.3
 -4.00  0.1005     80910.7   10588.7
 -2.00  0.1005     85343.5   10663.8
  0.00  0.1005     67890.6   10783.4
  2.00  0.0963     66429.0   10807.1
  4.00  0.0963     67449.2   10846.2
  5.00  0.1005     69689.9   10794.8
  6.00  0.1005     70756.3   10790.9
  7.00  0.1005     78088.3   10755.6
  8.00  0.1005     79067.0   10684.0
  9.00  0.1005     80711.3   10699.0
 10.00  0.1005     80698.2   10753.6
 11.00  0.1005     81676.7   10748.7
 12.00  0.1005     82708.0   10819.1
 12.25  0.1005     82941.9   10822.6
 12.50  0.1005     82985.5   10830.8
 12.75  0.1005     83251.5   10834.9
 13.00  0.1005     82958.2   10855.9
 14.00  0.1005     83547.0   10840.6
 15.00  0.1005     84944.7   11063.7
 16.00  0.1005     84270.3   11268.3
 17.00  0.1005     89418.4   11828.9
 18.00  0.1005     81613.9   12012.0
 20.00  0.1005     81455.5   11079.6
 13.00  0.1005     82361.2   10779.0
 12.75  0.1005     84312.5   10922.9
 12.50  0.1005     84537.2   10958.1
 12.25  0.1005     82843.3   10852.5
 12.00  0.1005     82426.4   10809.3
 11.75  0.1005     82335.8   10817.6
 11.50  0.1005     82240.9   10787.0
 11.25  0.1005     81715.7   10765.1
 11.00  0.1005     81276.5   10773.5
```

4.34 Re6h LER. ZZ 2% 200x200

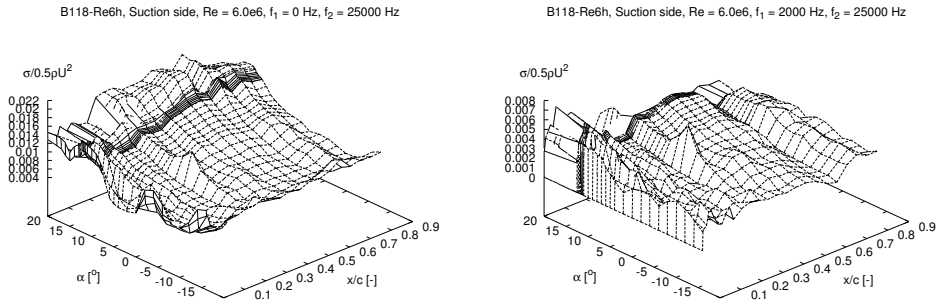

Figure 199: Pressure standard deviations, σ

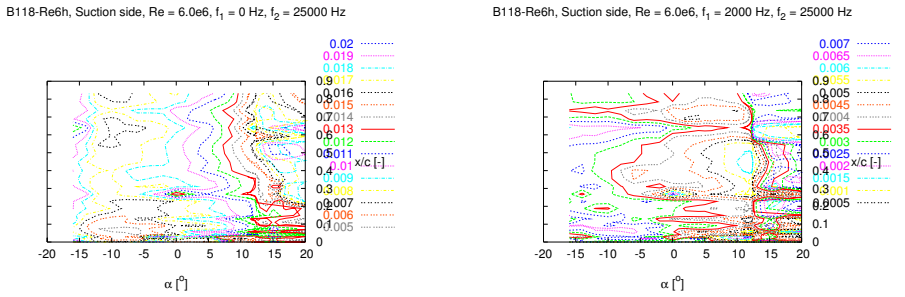

Figure 200: Contours of σ

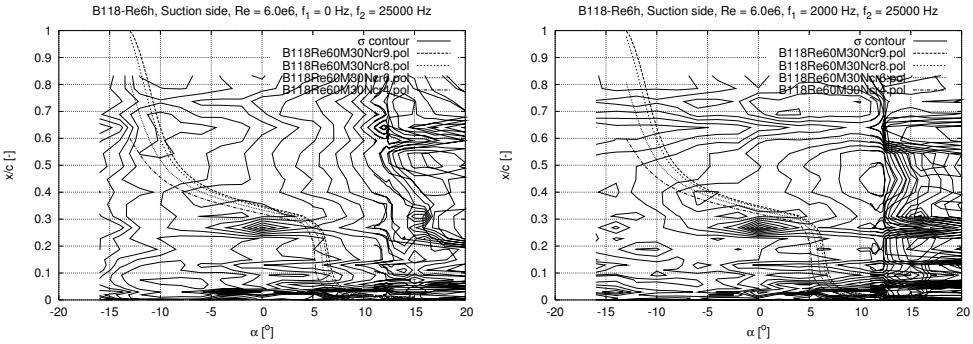

Figure 201: Contours of σ and XFoil data

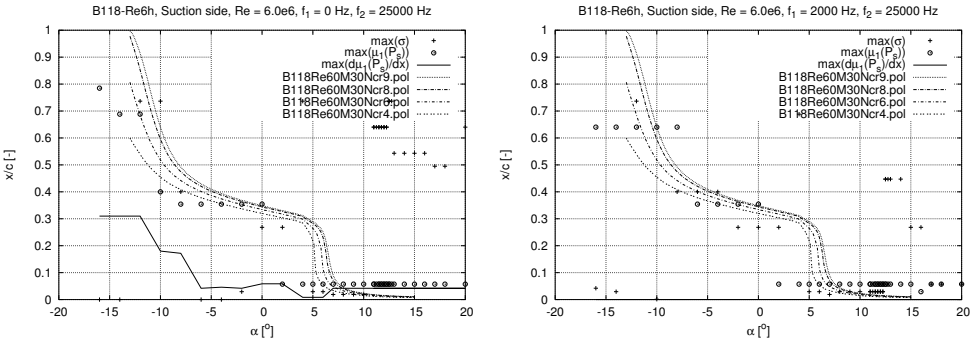

Figure 202: Transition detection

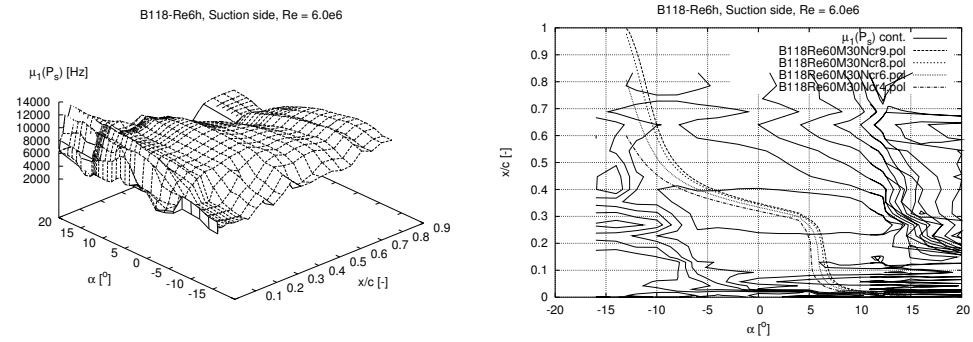

Figure 203: Fourier transform mean, $\mu_1(P_s)$

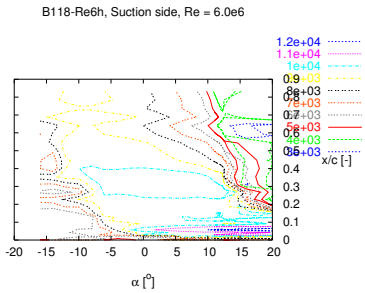

Figure 204: Contours of $\mu_1(P_s)$

B118-Re6h
alpha [degrees] angle of attack
xtr* [-] transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx* [Hz/-] d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1) [Hz] max mu1 of all chordwise positions

alpha	xtr*	d(mu1)/dx*	max(mu1)
-16.00	0.3098	29115.1	8769.2
-14.00	0.3098	36970.1	9176.6
-12.00	0.3098	40017.5	9719.0
-10.00	0.1800	35618.8	9990.0
-8.00	0.1716	39255.8	10219.0
-6.00	0.0419	32241.5	10576.4
-4.00	0.0460	44046.4	10574.3
-2.00	0.0419	54795.1	10639.6
0.00	0.0586	42245.7	10783.8
2.00	0.0586	43974.5	11030.4
4.00	0.0084	43751.3	11420.2
5.00	0.0084	43987.3	11641.4
6.00	0.0084	33564.8	11837.7
7.00	0.0419	39517.2	11895.5
8.00	0.0419	47035.6	11831.2
9.00	0.0419	48954.6	11876.1
10.00	0.0419	49781.2	11996.9
11.00	0.0419	50590.1	12129.0
11.50	0.0419	50145.5	12173.1
11.75	0.0419	50277.1	12182.4
12.00	0.0419	50334.8	12195.9
12.25	0.0419	50364.2	12193.5
12.50	0.0419	53371.0	12099.9
12.75	0.0419	53504.6	12059.3
13.00	0.0419	54185.4	12011.1
14.00	0.0419	55544.2	12114.4
15.00	0.0419	54007.5	12610.0
16.00	0.0419	44541.0	12503.9
17.00	0.0419	42483.6	12531.5
18.00	0.0419	42702.0	12662.7
20.00	0.0419	45435.8	12778.1
12.50	0.0419	52486.8	12012.3
12.25	0.0419	50690.3	12190.9
12.00	0.0419	50643.2	12204.2
11.75	0.0419	50267.7	12208.1
11.50	0.0419	50095.7	12171.7
11.25	0.0419	50328.7	12168.0
11.00	0.0419	50163.2	12146.7

4.35 Re6i Trip wire. Bump tape 0,1 2% 200x200

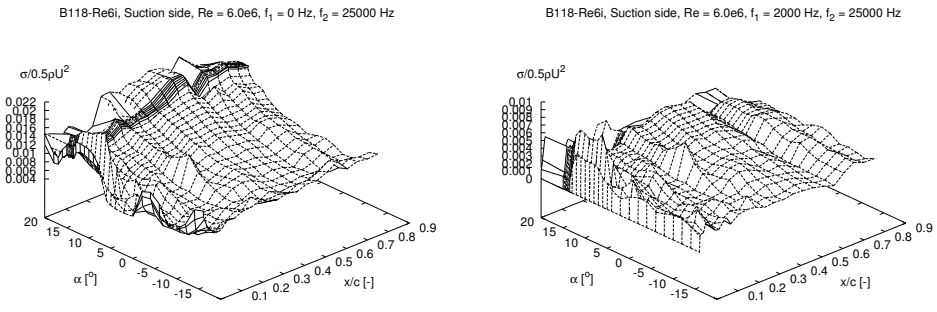

Figure 205: Pressure standard deviations, σ

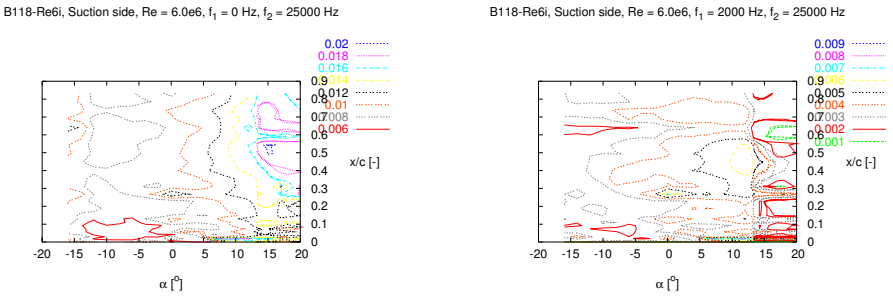

Figure 206: Contours of σ

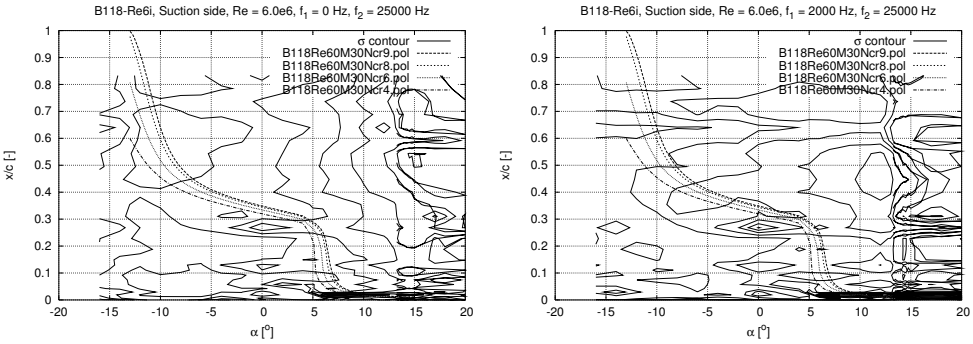

Figure 207: Contours of σ and XFoil data

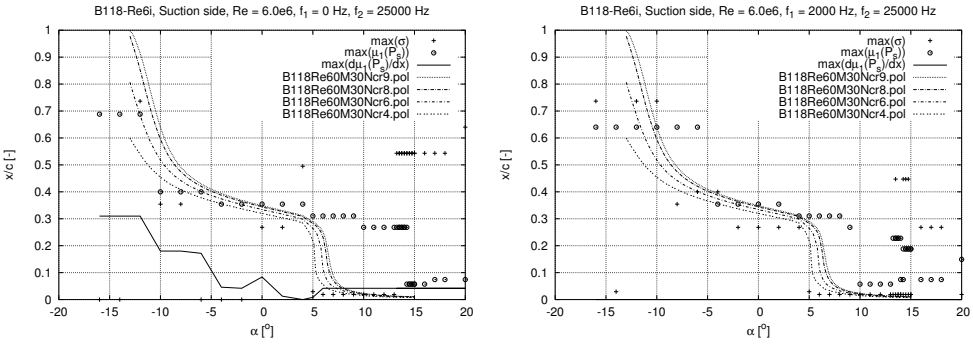

Figure 208: Transition detection

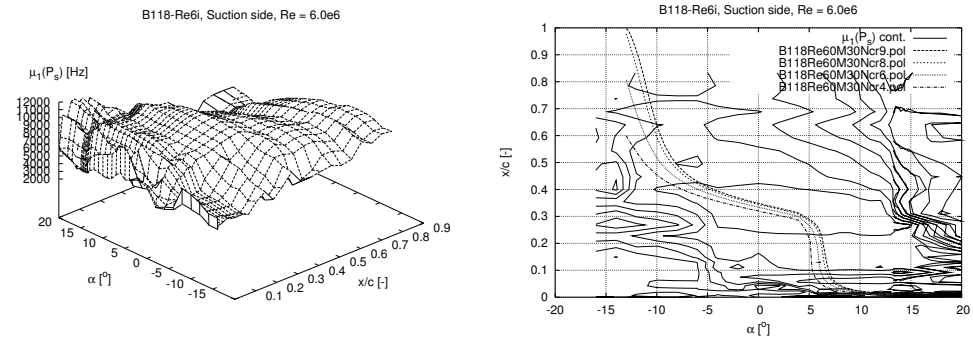

Figure 209: Fourier transform mean, $\mu_1(P_s)$

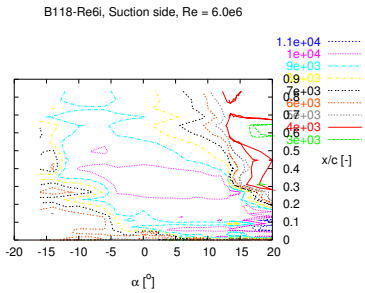

Figure 210: Contours of $\mu_1(P_s)$

```
B118-Re6i
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.3098     29065.1     8811.1
-14.00  0.3098     37918.4     9136.9
-12.00  0.3098     40202.8     9651.2
-10.00  0.1800     34923.2    10107.3
 -8.00  0.1800     35584.4    10320.5
 -6.00  0.1716     34910.3    10340.5
 -4.00  0.0460     36878.3    10612.7
 -2.00  0.0419     51459.0    10688.7
  0.00  0.0837     34518.9    10846.6
  2.00  0.0126     39386.0    10838.5
  4.00  0.0000     51996.3    10830.8
  5.00  0.0084     36175.9    10802.9
  6.00  0.0419     26712.2    10819.7
  7.00  0.0419     32029.0    10814.8
  8.00  0.0419     37692.7    10749.6
  9.00  0.0419     38984.2    10653.9
 10.00  0.0419     39313.1    10529.3
 11.00  0.0419     38618.6    10621.3
 12.00  0.0419     38932.5    10704.4
 13.00  0.0419     41465.6    10659.6
 13.50  0.0419     41421.6    10450.5
 13.75  0.0419     41761.2    10434.7
 14.00  0.0419     41139.8    10355.2
 14.25  0.0419     40906.6    10302.9
 14.50  0.0419     42753.2    10387.4
 14.75  0.0419     42835.1    10507.3
 15.00  0.0419     44194.4    10532.6
 16.00  0.0419     50716.3    10851.2
 17.00  0.0419     48877.0    11034.9
 18.00  0.0419     53300.8    11586.8
 20.00  0.0419     54329.4    11555.4
 15.00  0.0419     44170.5    10466.7
 14.75  0.0419     43718.5    10382.2
 14.50  0.0419     43180.2    10364.7
 14.25  0.0419     42796.9    10389.0
 14.00  0.0419     41290.3    10399.5
 13.75  0.0419     41951.7    10453.7
 13.50  0.0419     39773.1    10394.6
 13.25  0.0419     40452.0    10459.2
```

4.36 Re6j Clean 100x100

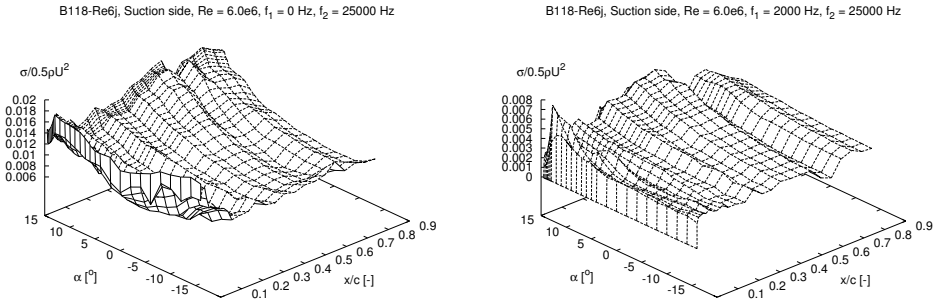

Figure 211: Pressure standard deviations, σ

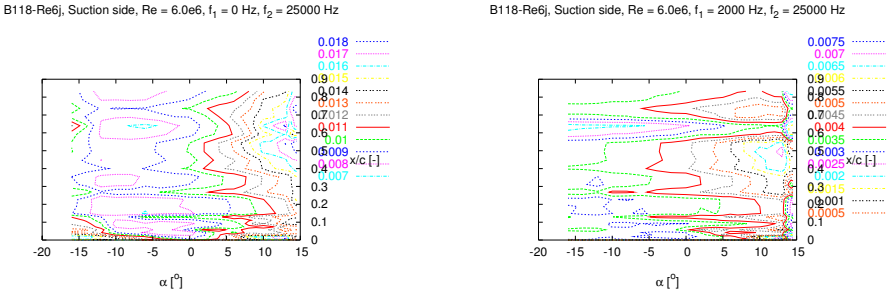

Figure 212: Contours of σ

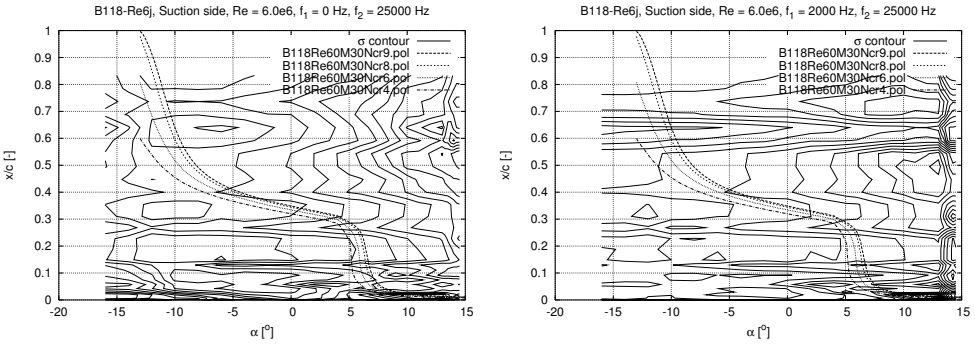

Figure 213: Contours of σ and XFoil data

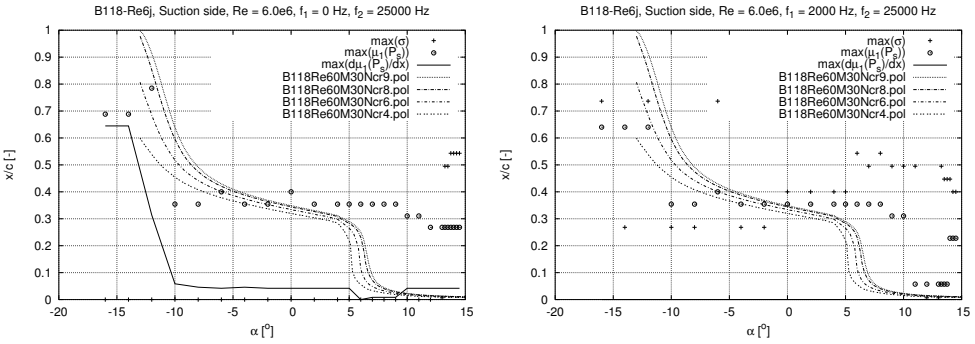

Figure 214: Transition detection

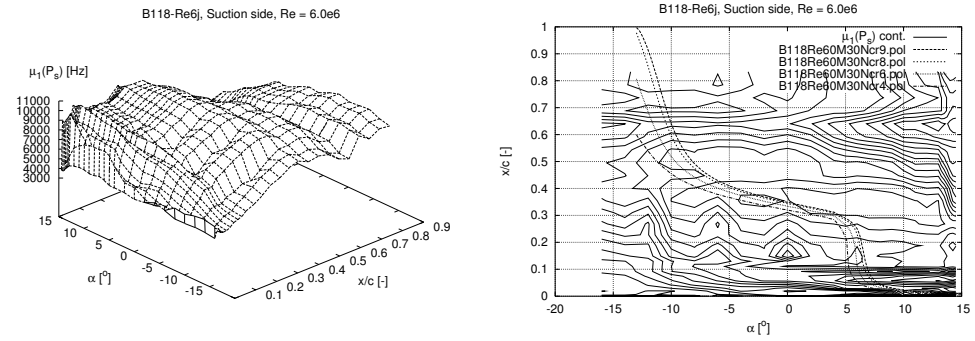

Figure 215: Fourier transform mean, $\mu_1(P_s)$

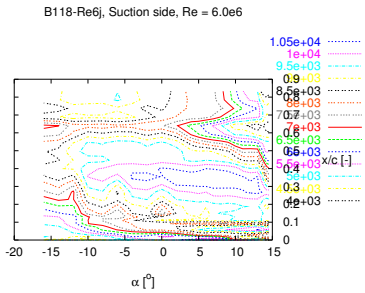

Figure 216: Contours of $\mu_1(P_s)$

```
B118-Re6j
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.6446     18145.3     8833.0
-14.00  0.6446     18546.8     8980.9
-12.00  0.3139     16767.4     9401.9
-10.00  0.0586     28256.1    10015.8
 -8.00  0.0460     31321.9    10198.8
 -6.00  0.0419     33067.9    10353.4
 -4.00  0.0460     34731.7    10578.4
 -2.00  0.0419     39722.9    10638.4
  0.00  0.0419     42132.8    10556.4
  2.00  0.0419     39240.0    10778.3
  4.00  0.0419     38837.0    10745.1
  5.00  0.0419     39086.0    10774.8
  6.00  0.0000     40234.4    10842.8
  7.00  0.0084     40000.6    10866.2
  8.00  0.0084     38042.9    10815.3
  9.00  0.0084     35604.4    10725.6
 10.00  0.0419     36303.9    10658.8
 11.00  0.0419     36215.5    10581.3
 12.00  0.0419     39029.5    10568.8
 13.00  0.0419     43973.5    10645.0
 13.25  0.0419     43979.7    10566.3
 13.50  0.0419     44206.1    10509.3
 13.75  0.0419     43789.3    10434.5
 14.00  0.0419     43733.0    10360.3
 14.25  0.0419     43779.2    10308.1
 14.50  0.0419     45402.5    10378.1
```

4.37 Re6jII Clean 100x100

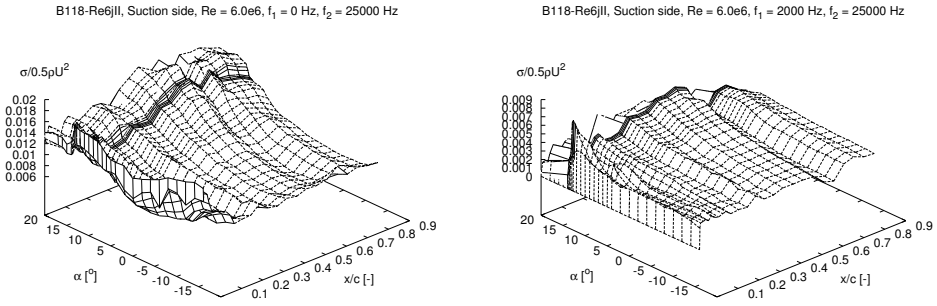

Figure 217: Pressure standard deviations, σ

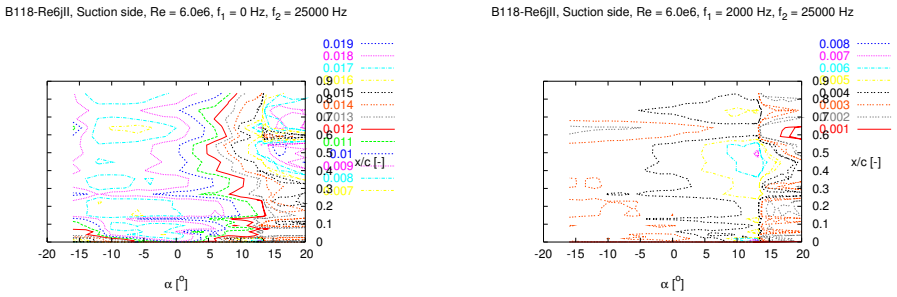

Figure 218: Contours of σ

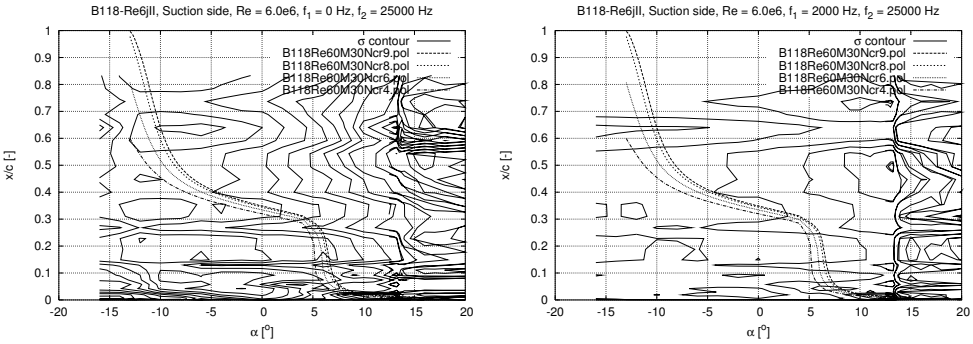

Figure 219: Contours of σ and XFoil data

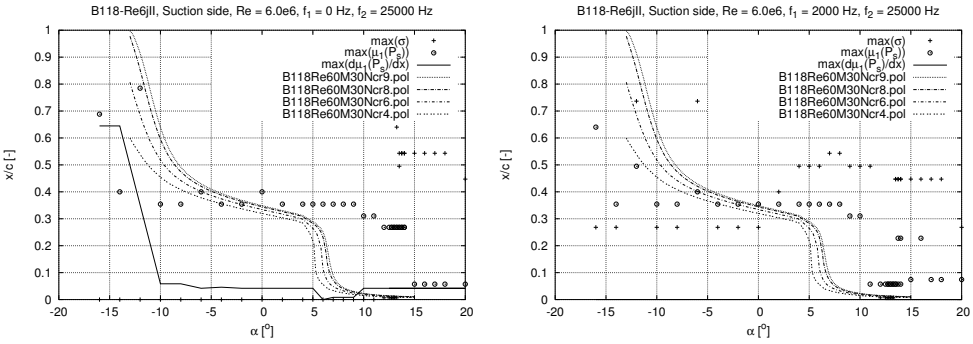

Figure 220: Transition detection

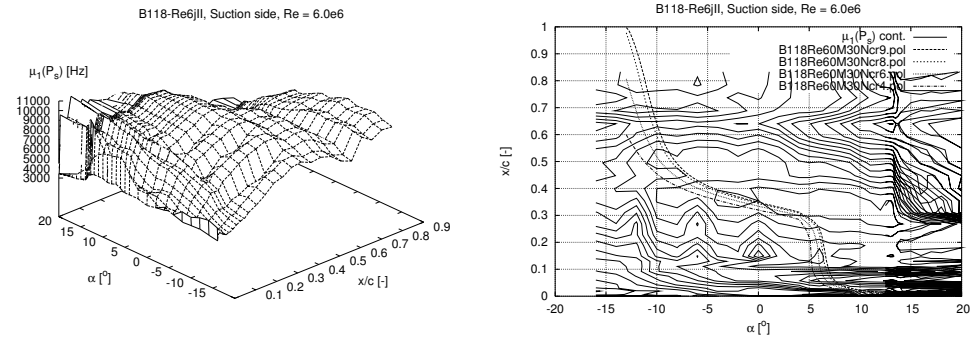

Figure 221: Fourier transform mean, $\mu_1(P_s)$

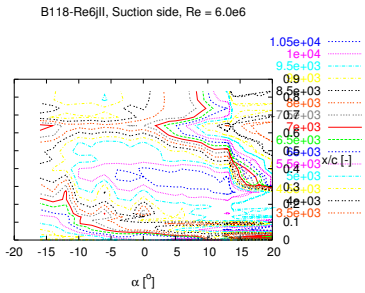

Figure 222: Contours of $\mu_1(P_s)$

```
B118-Re6jII
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.6446     19298.1    8828.2
-14.00  0.6446     19062.3    9022.7
-12.00  0.3516     18287.8    9424.4
-10.00  0.0586     27660.7   10043.7
 -8.00  0.0586     31196.2   10198.8
 -6.00  0.0419     33188.7   10456.9
 -4.00  0.0460     35138.9   10632.5
 -2.00  0.0419     40474.4   10660.0
  0.00  0.0419     43460.8   10584.3
  2.00  0.0419     40236.5   10808.3
  4.00  0.0419     39880.3   10762.0
  5.00  0.0419     40125.5   10774.2
  6.00  0.0000     39912.9   10841.6
  7.00  0.0084     39637.8   10863.0
  8.00  0.0084     38708.8   10810.2
  9.00  0.0084     36196.1   10749.7
 10.00  0.0419     36862.8   10659.0
 11.00  0.0419     37752.7   10561.3
 12.00  0.0419     39037.2   10600.6
 12.75  0.0419     42325.1   10680.8
 13.00  0.0419     43744.6   10684.6
 13.25  0.0419     45135.4   10689.2
 13.50  0.0419     45848.3   10651.0
 13.75  0.0419     46088.1   10563.9
 14.00  0.0419     45251.4   10512.2
 15.00  0.0419     48405.2   10432.3
 16.00  0.0419     49634.6   10348.1
 17.00  0.0419     52873.1   10592.9
 18.00  0.0419     55769.8   10701.7
 20.00  0.0419     68286.7   10979.2
 14.00  0.0419     47801.4   10531.7
 13.75  0.0419     46182.6   10552.5
 13.50  0.0419     46263.1   10638.9
 13.25  0.0419     45611.1   10698.4
 13.00  0.0419     44642.4   10673.0
 12.75  0.0419     42969.9   10672.0
 12.50  0.0419     41347.6   10647.9
```

4.38 Re6k ZZ90 x/c=5% suc. x/c=10% press. 100x100

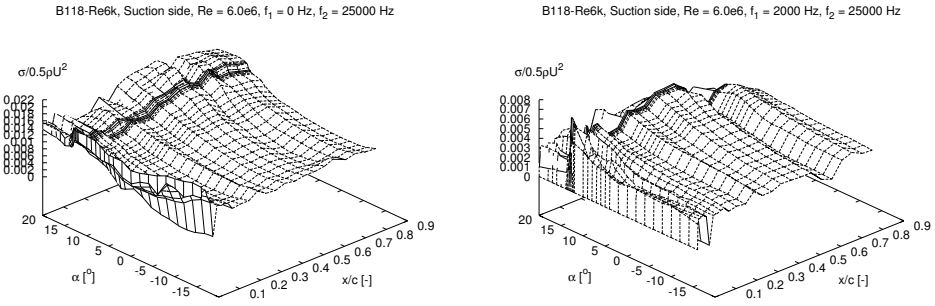

Figure 223: Pressure standard deviations, σ

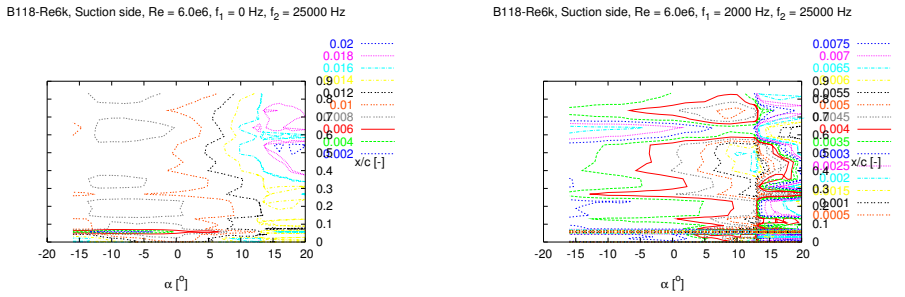

Figure 224: Contours of σ

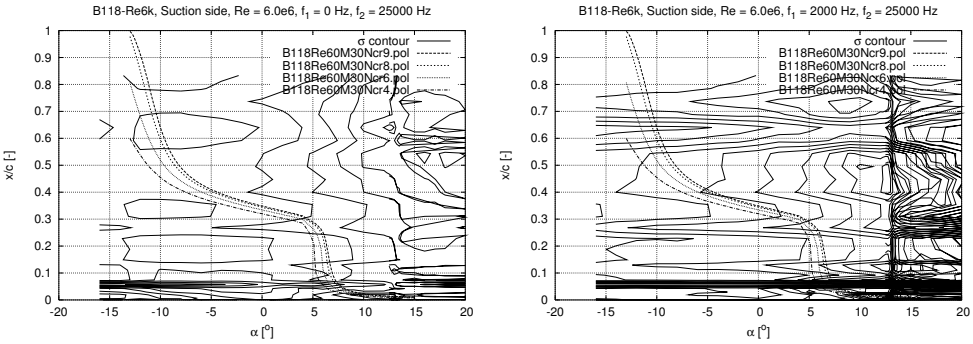

Figure 225: Contours of σ and XFoil data

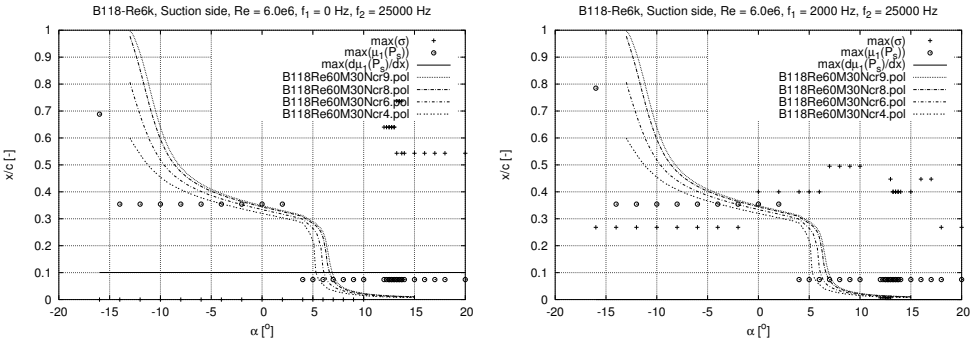

Figure 226: Transition detection

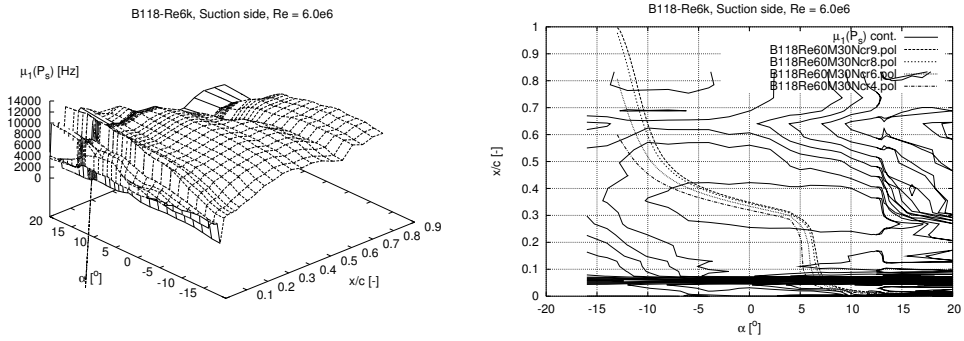

Figure 227: Fourier transform mean, $\mu_1(P_s)$

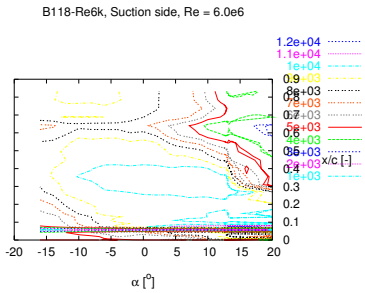

Figure 228: Contours of $\mu_1(P_s)$

```
B118-Re6k
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.1005     54960.9    8790.2
-14.00  0.1005     57752.8    9082.3
-12.00  0.1005     64383.4    9748.9
-10.00  0.1005     71320.5   10035.2
 -8.00  0.1005     77452.0   10181.0
 -6.00  0.1005     83765.4   10490.6
 -4.00  0.1005     83612.9   10588.0
 -2.00  0.1005     84291.9   10616.8
  0.00  0.1005     87221.6   10710.0
  2.00  0.1005     85922.0   10750.8
  4.00  0.1005     81168.6   10991.9
  5.00  0.1005     79787.5   11274.8
  6.00  0.1005     83349.4   11478.2
  7.00  0.1005     85834.1   11522.2
  8.00  0.1005     87757.7   11432.4
  9.00  0.1005     88474.0   11564.6
 10.00  0.1005     88701.8   11888.2
 12.00  0.1005     89738.8   11991.5
 12.25  0.1005     89819.5   11954.2
 12.50  0.1005     90700.4   11934.5
 12.75  0.1005     90572.0   11911.4
 13.00  0.1005     89976.3   11940.2
 13.25  0.1005     89587.4   12104.0
 13.50  0.1005     89566.9   12067.7
 13.75  0.1005     88835.8   12102.6
 14.00  0.1005     88816.5   12142.0
 15.00  0.1005     91155.0   12402.0
 16.00  0.1005     90946.5   12227.3
 17.00  0.1005     92211.5   12093.5
 18.00  0.1005     92848.5   12022.4
 20.00  0.1005     98793.4   11826.7
 13.75  0.1005     89243.5   12173.5
 13.50  0.1005     88107.2   12142.0
 13.25  0.1005     88450.4   12015.0
 13.00  0.1005     90454.3   11969.7
 12.75  0.1005     89996.4   11970.7
 12.50  0.1005     89633.8   11994.6
```

4.39 Re6m Trip wire. Bump tape 0,1 2% 100x100

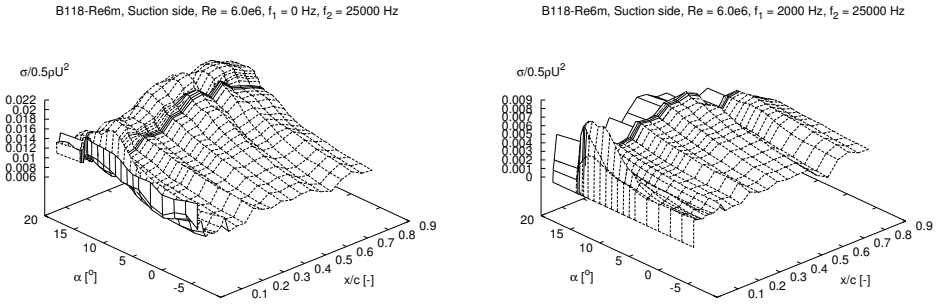

Figure 229: Pressure standard deviations, σ

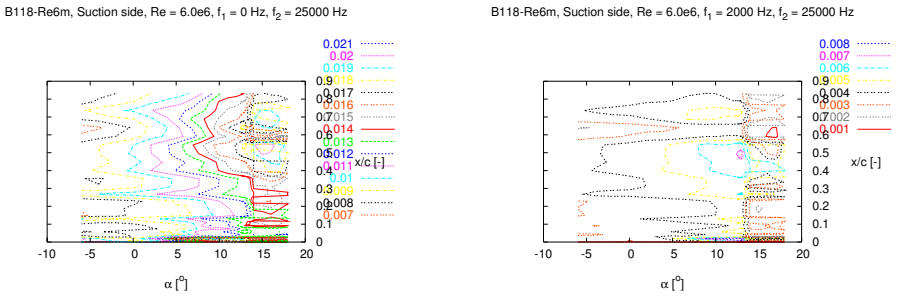

Figure 230: Contours of σ

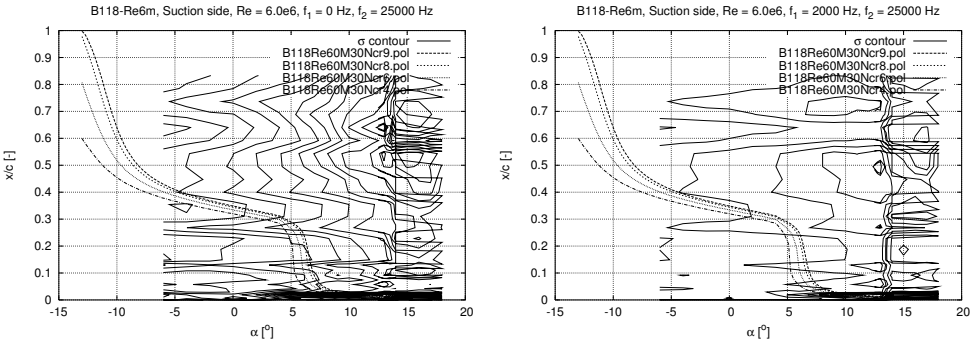

Figure 231: Contours of σ and XFoil data

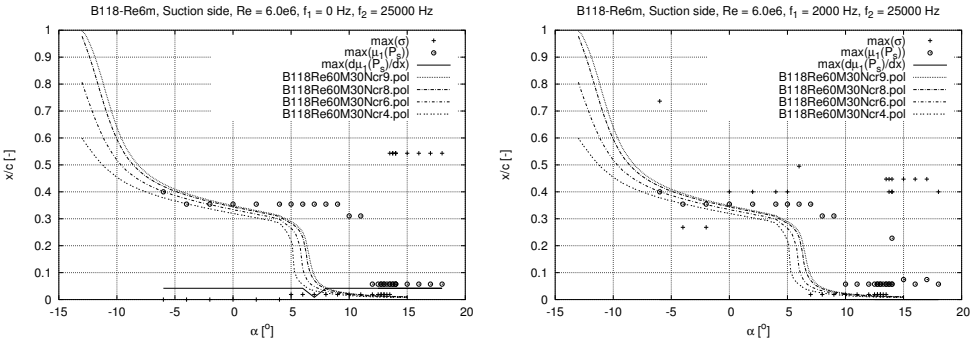

Figure 232: Transition detection

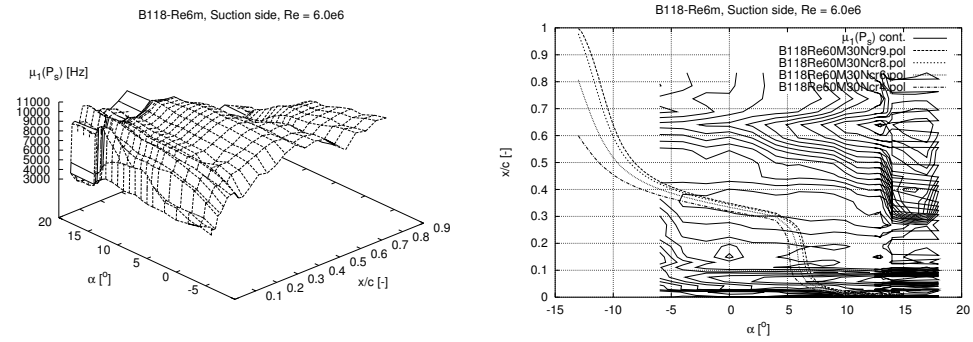

Figure 233: Fourier transform mean, $\mu_1(P_s)$

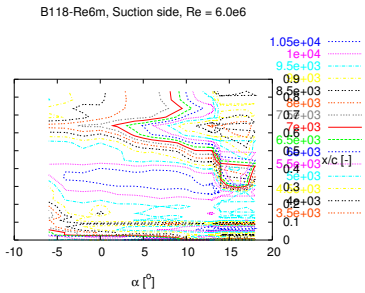

Figure 234: Contours of $\mu_1(P_s)$

```
B118-Re6m
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
 -6.00  0.0419     37919.9   10369.6
 -4.00  0.0419     38967.9   10617.5
 -2.00  0.0419     45167.4   10628.8
  0.00  0.0419     48210.2   10718.2
  2.00  0.0419     44976.5   10789.5
  4.00  0.0419     45565.8   10742.3
  5.00  0.0419     44840.7   10772.2
  6.00  0.0419     42943.8   10819.4
  7.00  0.0084     39347.9   10838.4
  8.00  0.0419     37874.3   10792.1
  9.00  0.0419     39465.1   10729.2
 10.00  0.0419     40597.2   10662.0
 11.00  0.0419     40037.7   10548.5
 12.00  0.0419     41835.8   10646.6
 12.75  0.0419     46878.2   10747.2
 13.00  0.0419     48995.0   10782.3
 13.25  0.0419     48814.0   10638.4
 13.50  0.0419     49064.1   10716.3
 13.75  0.0419     48608.3   10668.8
 14.00  0.0419     48067.2   10637.1
 14.00  0.0419     51349.4   10631.5
 15.00  0.0419     55006.6   10692.9
 16.00  0.0419     56678.0   10861.9
 17.00  0.0419     62842.9   10974.4
 18.00  0.0419     48583.6   10642.2
 14.00  0.0419     49839.5   10557.9
 13.75  0.0419     49955.1   10674.9
 13.50  0.0419     49834.3   10726.6
 13.00  0.0419     49463.1   10780.9
 12.75  0.0419     47236.8   10732.1
 12.50  0.0419     44874.8   10693.9
```

5 Pressure side

5.1 Re16a Clean -

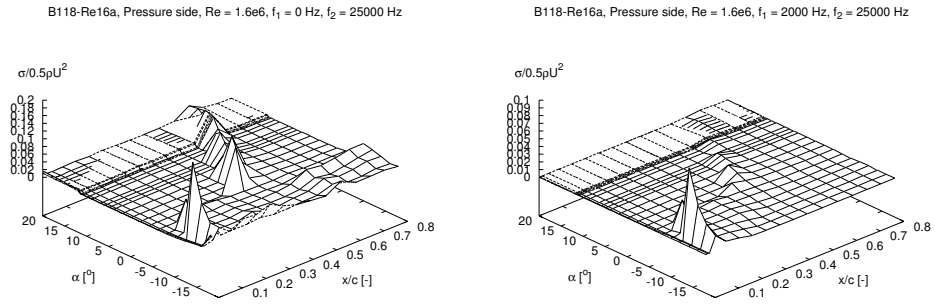

Figure 235: Pressure standard deviations, σ

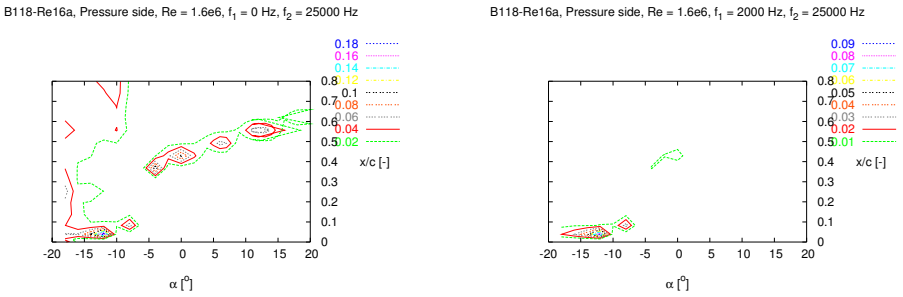

Figure 236: Contours of σ

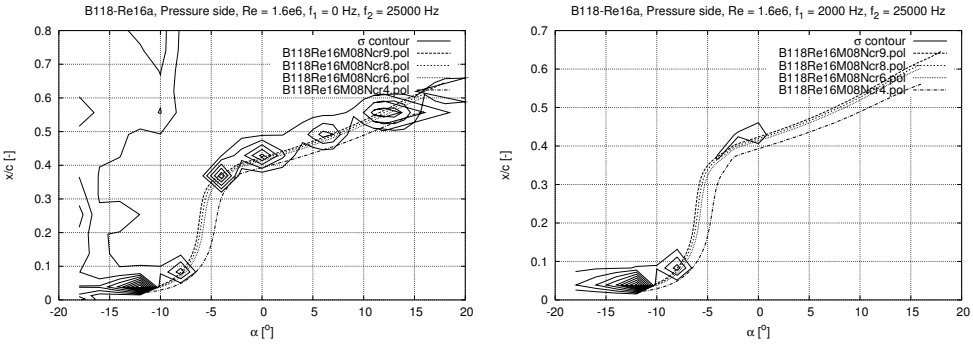

Figure 237: Contours of σ and XFoil data

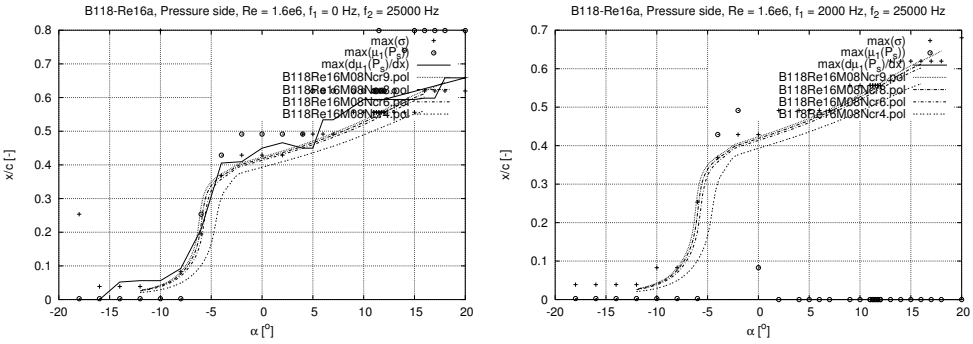

Figure 238: Transition detection

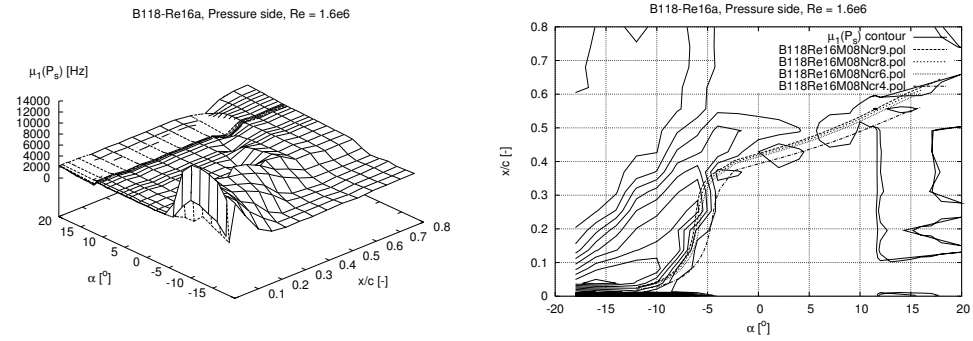

Figure 239: Fourier transform mean, $\mu_1(P_s)$

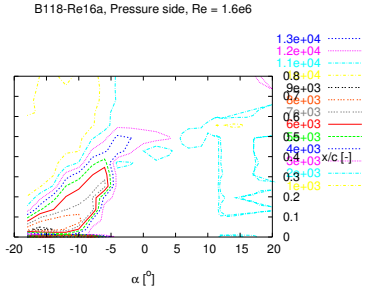

Figure 240: Contours of $\mu_1(P_s)$

```
B118-Re16a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     56747.4    9915.4
-16.00  0.0000     50033.9   12583.5
-14.00  0.0522     40663.0   13201.0
-12.00  0.0562     37581.9   13548.0
-10.00  0.0562     58541.7   13415.4
 -8.00  0.0923     54990.7   11534.8
 -6.00  0.2088     50211.5    7314.6
 -4.00  0.4055     35070.0    4756.0
 -2.00  0.4095     19364.3    4041.1
  0.00  0.4497     18755.3    3735.8
  2.00  0.4658     24173.9    3460.4
  4.00  0.4497     12697.1    3070.2
  5.00  0.4497      4893.1    2825.8
  6.00  0.5340      9350.8    2814.4
  7.00  0.5340     16347.8    2795.8
  9.00  0.5742      9808.0    2768.0
 10.00  0.5942     10275.2    2719.4
 11.00  0.5942     16558.3    2654.4
 11.25  0.5942     17887.2    2659.2
 11.50  0.5942     18694.0    2627.9
 11.75  0.5942     18690.1    2687.2
 12.00  0.5942     18407.3    2753.8
 13.00  0.5942     20550.7    2792.3
 14.00  0.5942     22262.6    2804.4
 15.00  0.5942     20993.3    2844.8
 16.00  0.5983     17092.2    2928.2
 17.00  0.5983     11722.1    2978.4
 18.00  0.6585     12062.6    3039.5
 20.00  0.6585     20046.4    3112.9
 12.00  0.5942     17710.7    2743.7
 11.75  0.5942     17521.6    2666.6
 11.50  0.5942     18830.3    2644.1
 11.25  0.5942     17988.9    2652.6
 11.00  0.5942     16840.5    2665.8
```

5.2 Re16b ZZ90 x/c=5% suc. x/c=10% press. -

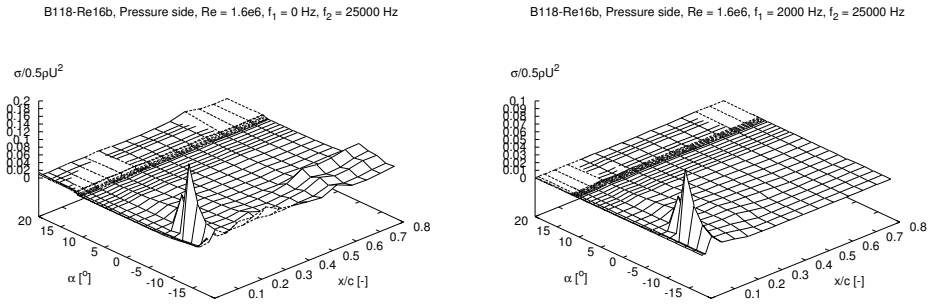

Figure 241: Pressure standard deviations, σ

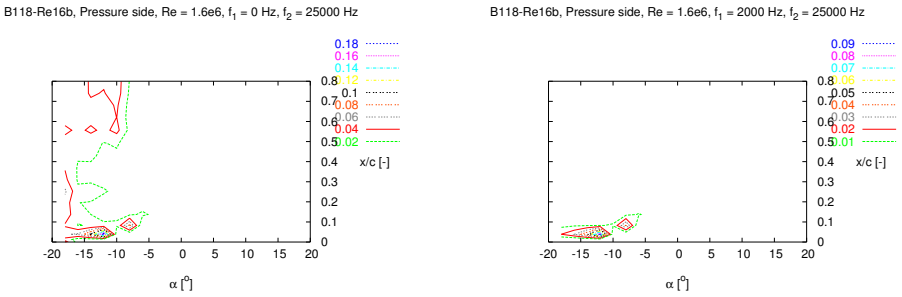

Figure 242: Contours of σ

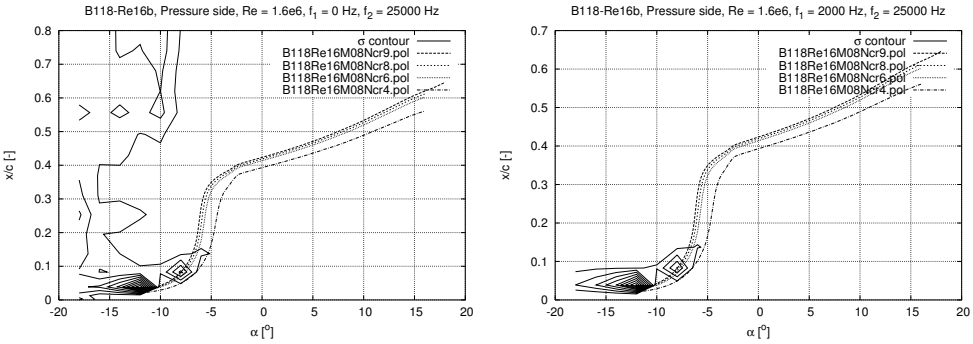

Figure 243: Contours of σ and XFoil data

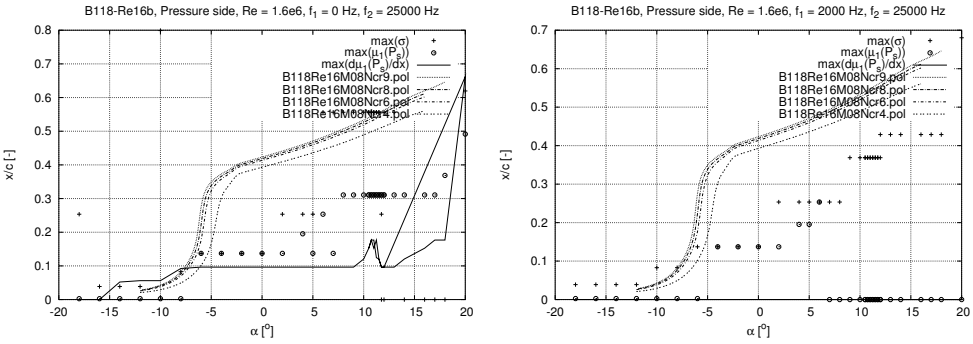

Figure 244: Transition detection

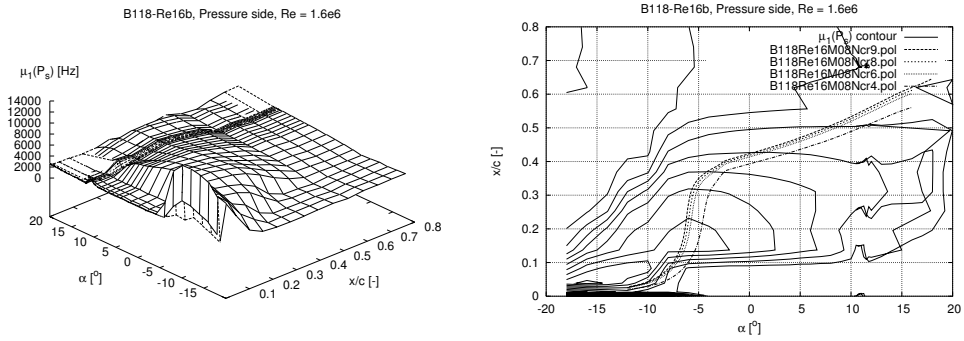

Figure 245: Fourier transform mean, $\mu_1(P_s)$

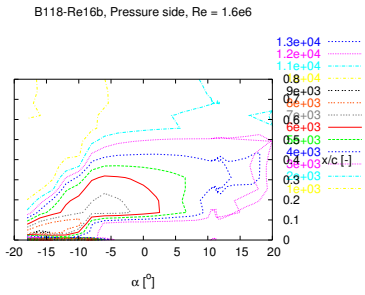

Figure 246: Contours of $\mu_1(P_s)$

B118-Re16b
alpha [degrees] angle of attack
xtr* [-] transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx* [Hz/-] d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1) [Hz] max mu1 of all chordwise positions

alpha	xtr*	d(mu1)/dx*	max(mu1)
-18.00	0.0000	53446.0	10411.6
-16.00	0.0000	49187.5	12461.9
-14.00	0.0522	38890.7	13102.2
-12.00	0.0562	36555.4	13429.4
-10.00	0.0562	54234.7	13366.0
-8.00	0.0923	41786.1	11626.0
-6.00	0.0964	56966.2	7397.5
-4.00	0.0964	57324.0	7347.7
-2.00	0.0964	55201.7	7004.6
0.00	0.0964	49833.8	6598.4
2.00	0.0964	45482.9	6155.1
4.00	0.0964	37743.8	5600.5
5.00	0.0964	35803.5	5317.8
6.00	0.0964	32231.0	5097.9
7.00	0.0964	31492.4	4958.5
8.00	0.0964	27438.0	4796.4
9.00	0.0964	22424.3	4625.9
10.00	0.1205	13908.1	4486.6
10.50	0.1526	10777.9	4418.1
10.75	0.1767	10047.3	4410.9
11.00	0.1526	10216.4	4403.1
11.25	0.1767	9917.8	4389.9
11.50	0.1205	14493.2	4518.0
11.75	0.0964	16502.0	4558.6
12.00	0.0964	19031.7	4593.4
13.00	0.0964	15944.2	4403.3
14.00	0.1205	12453.6	4358.2
16.00	0.1526	11952.9	4370.8
17.00	0.1767	13333.0	4344.4
18.00	0.1767	13982.3	4047.1
20.00	0.6625	9435.8	2989.2
12.00	0.0964	17323.5	4472.8
11.75	0.0964	16908.9	4377.4
11.50	0.1205	15485.4	4562.5
11.25	0.1245	11171.4	4487.5
11.00	0.1767	10088.9	4418.9
10.75	0.1767	10214.9	4441.8
10.50	0.1526	10897.2	4444.9

5.3 Re16c LM standard LER. ZZ 2% -

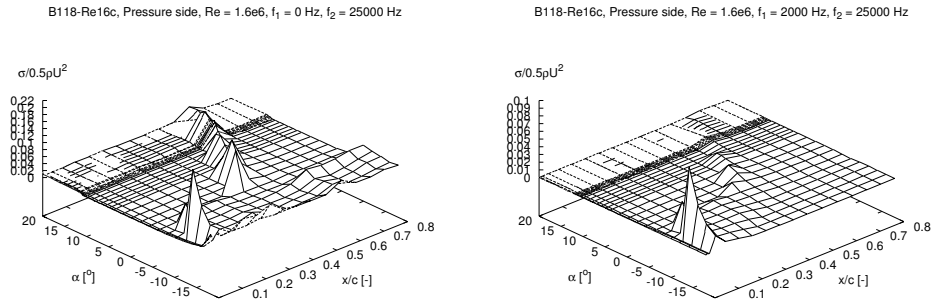

Figure 247: Pressure standard deviations, σ

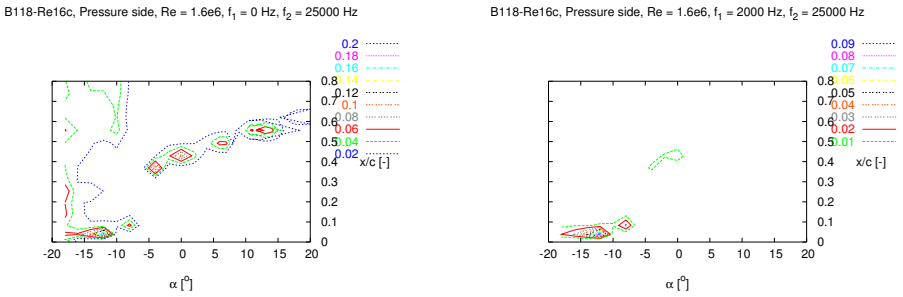

Figure 248: Contours of σ

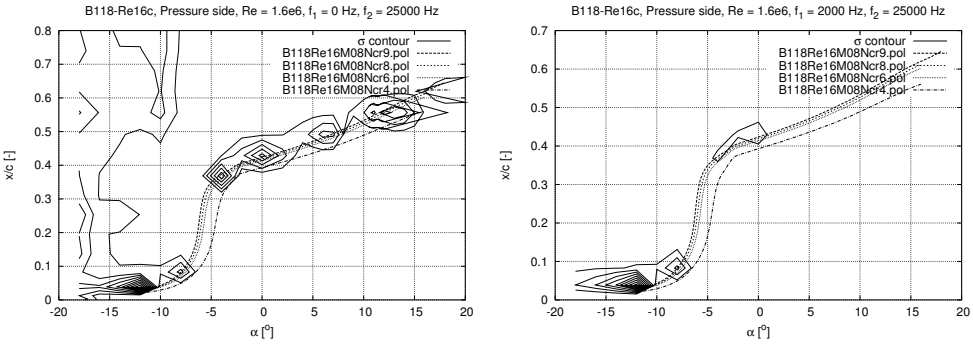

Figure 249: Contours of σ and XFoil data

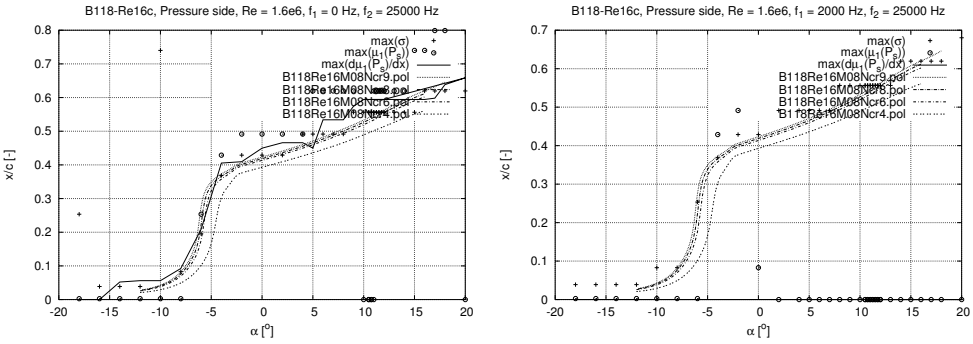

Figure 250: Transition detection

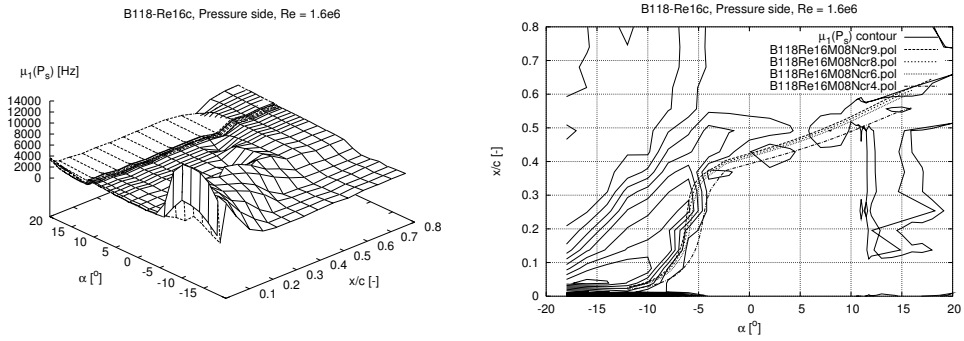

Figure 251: Fourier transform mean, $\mu_1(P_s)$

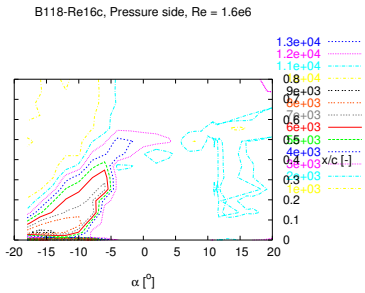

Figure 252: Contours of $\mu_1(P_s)$

```
B118-Re16c
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     56920.7    9858.8
-16.00  0.0000     51661.5   12443.7
-14.00  0.0522     39814.7   13524.5
-12.00  0.0562     37858.6   13725.1
-10.00  0.0562     58570.4   13552.0
 -8.00  0.0923     56575.5   11555.7
 -6.00  0.2088     51424.7    7294.0
 -4.00  0.4055     34804.3    4794.5
 -2.00  0.4095     19706.3    4068.1
  0.00  0.4497     18624.2    3760.7
  2.00  0.4658     24731.1    3532.2
  4.00  0.4658     13521.3    3129.4
  5.00  0.4497      5814.4    2870.8
  6.00  0.5340      8666.9    2860.5
  7.00  0.5340     16172.6    2847.4
  8.00  0.5340     17382.9    2848.3
  9.00  0.5742     10504.5    2829.8
 10.00  0.5942     10212.6    2969.2
 10.50  0.5942     13438.7    3003.4
 10.75  0.5942     15239.7    3023.4
 11.00  0.5942     16544.3    3066.9
 11.25  0.5942     14035.5    2844.1
 11.50  0.5942     14460.4    2911.9
 11.75  0.5942     15142.5    2931.9
 12.00  0.5942     16322.9    2936.1
 13.00  0.5942     19676.5    2880.6
 14.00  0.5942     22198.7    2854.6
 15.00  0.5942     22397.2    2891.0
 16.00  0.5942     19196.6    2945.0
 17.00  0.5983     13420.6    2961.6
 18.00  0.6384     11922.2    2991.3
 20.00  0.6585     20319.6    3664.7
 12.00  0.5942     15944.9    2946.1
 11.75  0.5942     14784.7    2883.5
 11.50  0.5942     14190.4    2954.1
 11.25  0.5942     13999.9    2884.5
 11.00  0.5942     14204.2    2850.5
 10.75  0.5942     15171.6    3072.5
 10.50  0.5942     13933.5    2990.6
```

5.4 Re16d Trip wire. Bump tape 2% -

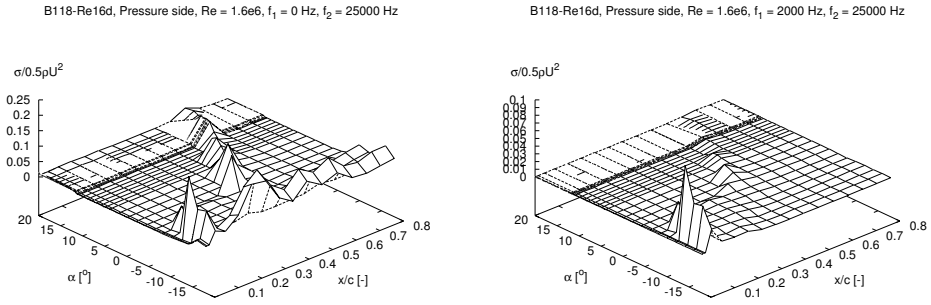

Figure 253: Pressure standard deviations, σ

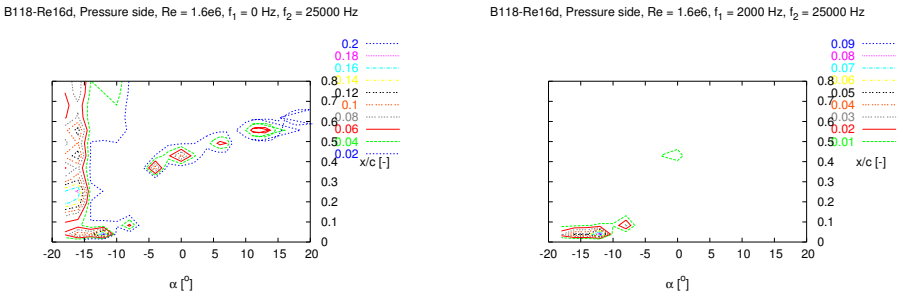

Figure 254: Contours of σ

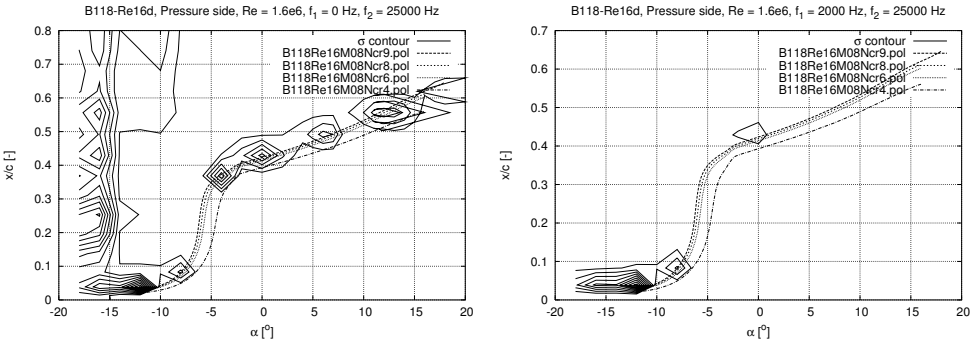

Figure 255: Contours of σ and XFoil data

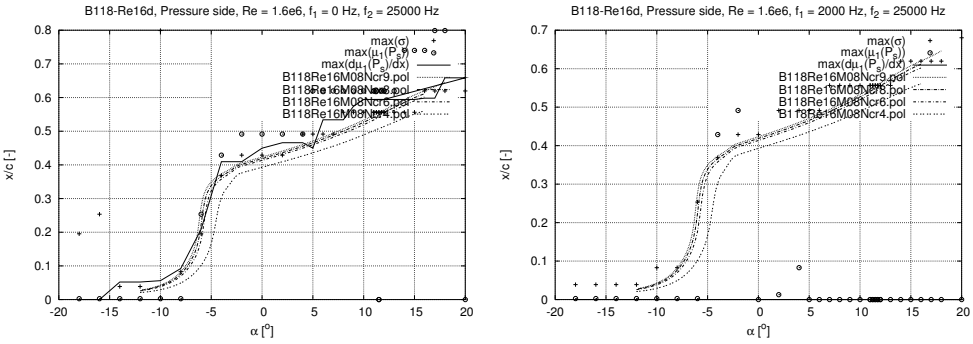

Figure 256: Transition detection

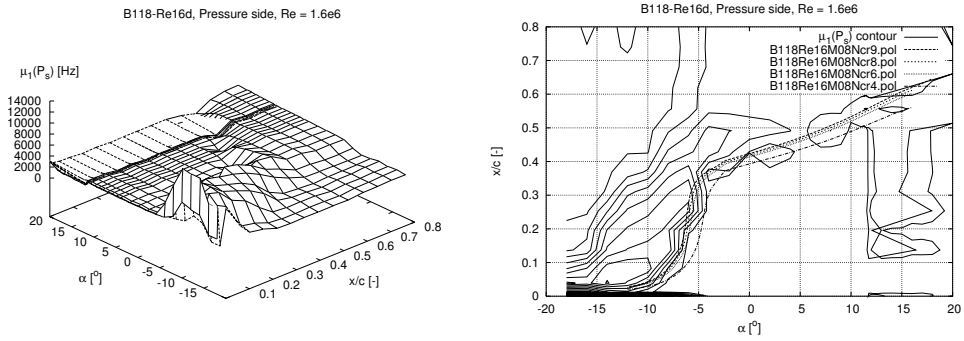

Figure 257: Fourier transform mean, $\mu_1(P_s)$

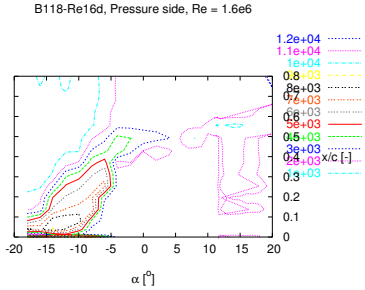

Figure 258: Contours of $\mu_1(P_s)$

```
B118-Re16d
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     58100.9    8598.7
-16.00  0.0000     55326.3    8597.1
-14.00  0.0522     39193.9   12505.4
-12.00  0.0522     37096.9   12564.0
-10.00  0.0562     57956.0   12827.0
 -8.00  0.0923     56269.3    9122.0
 -6.00  0.2088     53040.3    7246.5
 -4.00  0.4095     34831.2    4653.5
 -2.00  0.4095     19024.7    4028.9
  0.00  0.4497     18609.6    3715.6
  2.00  0.4658     24143.4    3443.6
  4.00  0.4658     12009.1    3027.4
  5.00  0.4497      4367.5    2823.2
  6.00  0.5340      9464.9    2804.3
  7.00  0.5340     16550.5    2802.1
  8.00  0.5340     16577.6    2793.0
  9.00  0.5742      9686.5    2759.5
 10.00  0.5942     10289.7    2708.0
 11.00  0.5942     16621.7    2649.8
 11.25  0.5942     17787.1    2639.2
 11.50  0.5942     18665.1    2642.7
 11.75  0.5942     17454.9    2745.1
 12.00  0.5942     18046.4    2800.7
 13.00  0.5942     20460.4    2776.8
 14.00  0.5942     22429.6    2795.6
 15.00  0.5942     21072.3    2845.1
 16.00  0.5983     16598.3    2883.4
 17.00  0.5983     11016.5    2900.0
 18.00  0.6585     12694.0    2958.8
 20.00  0.6585     19650.9    3050.7
 12.00  0.5942     17807.6    2764.6
 11.75  0.5942     17101.5    2718.2
 11.50  0.5942     19106.3    2674.3
 11.25  0.5942     18092.3    2666.2
 11.00  0.5942     16864.0    2663.2
```

5.5 Re16e Clean -

Figure 259: Pressure standard deviations, σ

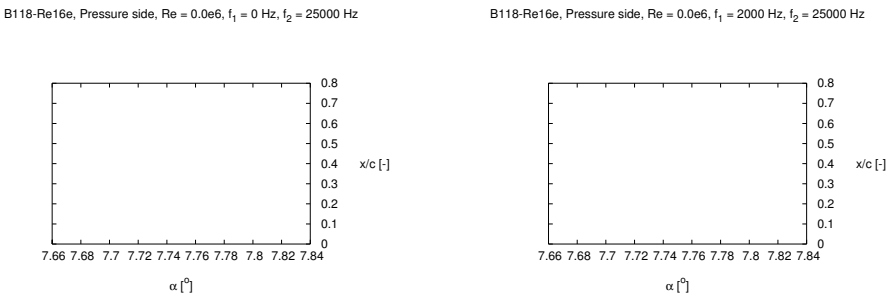

Figure 260: Contours of σ

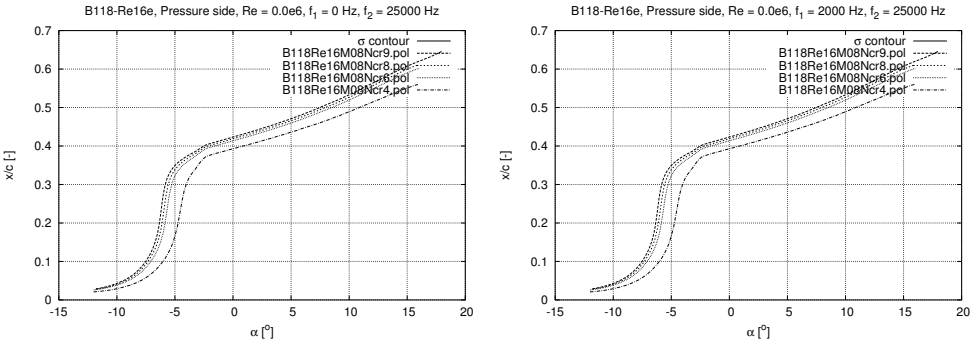

Figure 261: Contours of σ and XFoil data

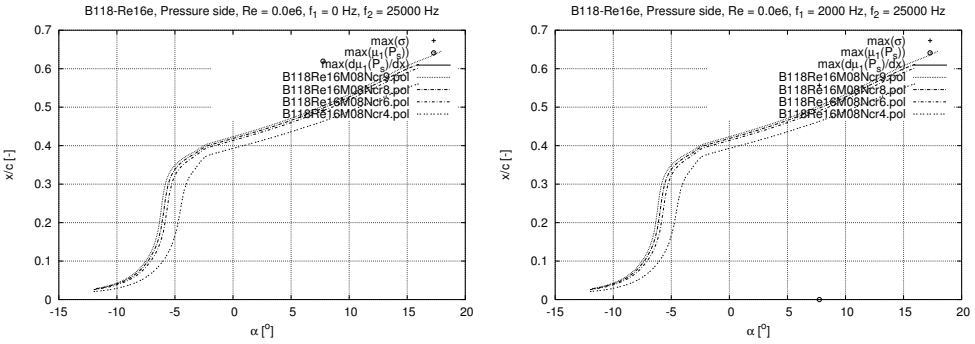

Figure 262: Transition detection

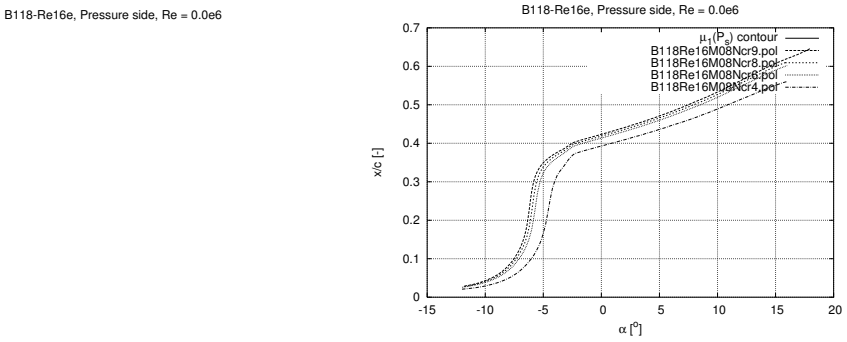

Figure 263: Fourier transform mean, $\mu_1(P_s)$

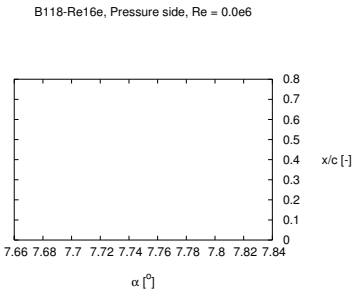

Figure 264: Contours of $\mu_1(P_s)$

```
B118-Re16e
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
  7.75  0.5340     15562.5    2659.8
```

5.6 Re16f Clean 200x200

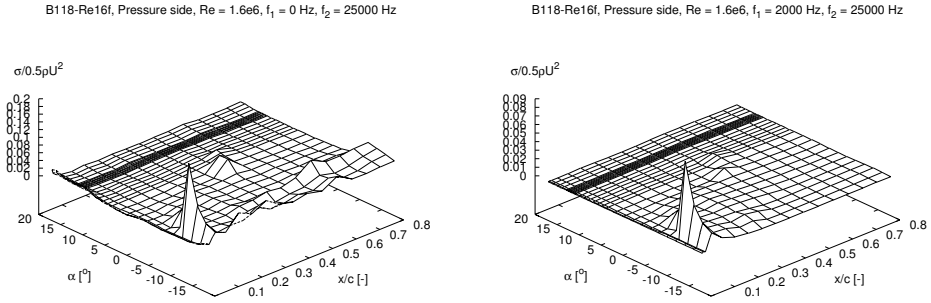

Figure 265: Pressure standard deviations, σ

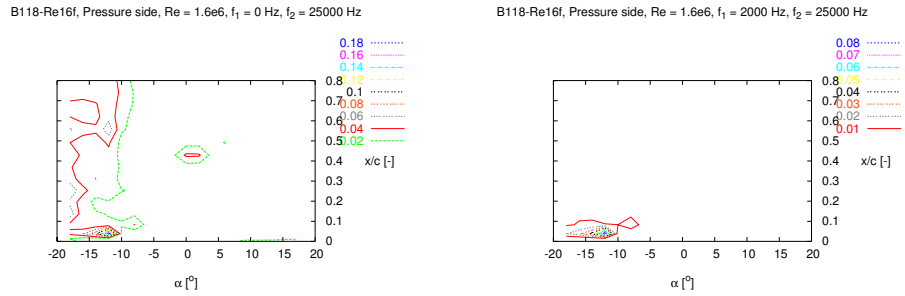

Figure 266: Contours of σ

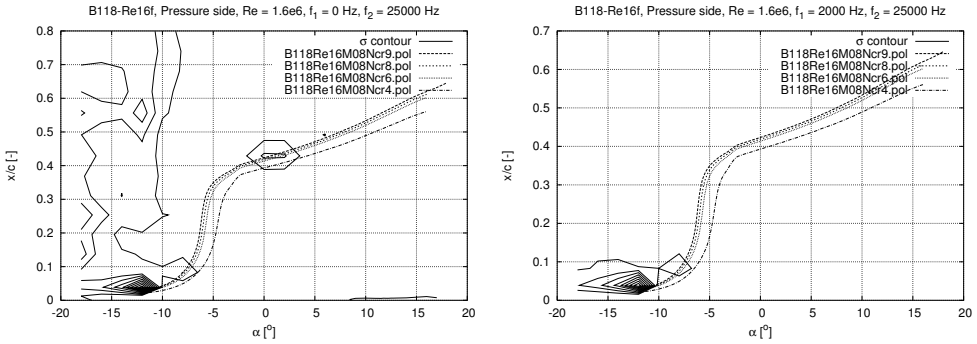

Figure 267: Contours of σ and XFoil data

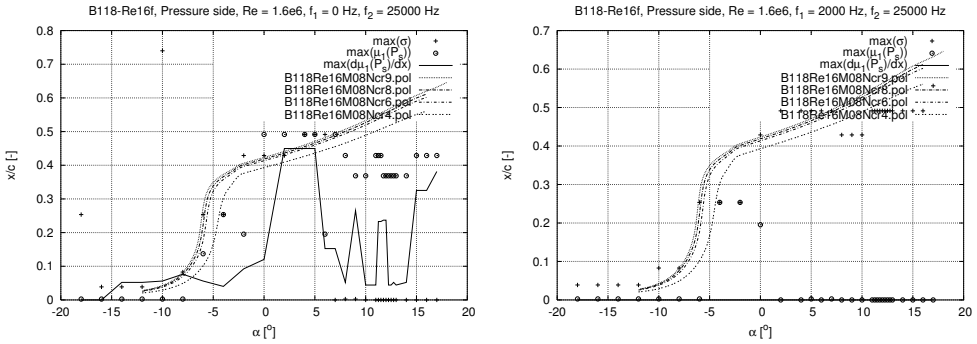

Figure 268: Transition detection

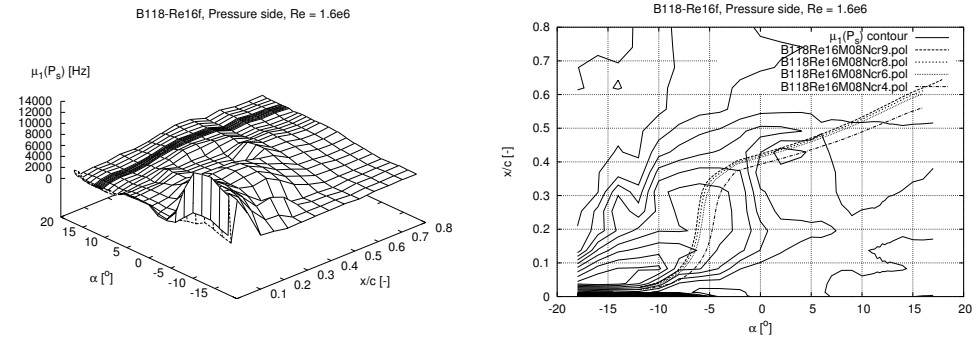

Figure 269: Fourier transform mean, $\mu_1(P_s)$

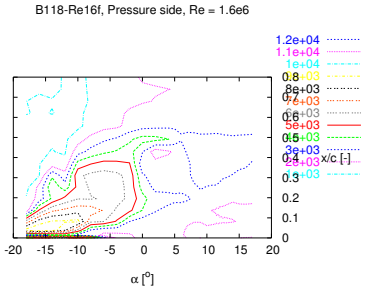

Figure 270: Contours of $\mu_1(P_s)$

```
B118-Re16f
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     62336.6   10781.4
-16.00  0.0000     65694.2   11678.3
-14.00  0.0522     55928.4   12757.8
-12.00  0.0522     52502.7   12538.1
-10.00  0.0562     67604.3   12109.4
 -8.00  0.0763     51370.2    8562.4
 -6.00  0.0562     53083.3    6904.2
 -4.00  0.0402     44209.2    6435.2
 -2.00  0.0923     33009.1    5767.7
  0.00  0.1205     19722.3    4370.6
  2.00  0.4497     29865.0    4316.4
  4.00  0.4497     22932.6    4017.5
  5.00  0.4497     15948.7    3594.7
  6.00  0.1526     15286.5    3475.1
  7.00  0.1526     11492.4    3535.1
  8.00  0.0522      9497.5    3795.6
  9.00  0.2650     11655.0    3914.4
 10.00  0.0442     11164.7    3707.6
 11.00  0.0442      9634.4    3521.7
 11.25  0.2329      9553.4    3543.2
 11.50  0.2329      9857.0    3518.5
 11.75  0.2369      9589.9    3501.9
 12.00  0.2369      9590.7    3512.2
 12.25  0.0442      9506.7    3496.1
 12.50  0.0442      9320.3    3489.5
 12.75  0.0522      8529.0    3506.5
 13.00  0.0442      9391.9    3441.4
 14.00  0.0522      8373.4    3376.3
 15.00  0.3252      8107.3    3401.8
 16.00  0.3252      8374.0    3453.5
 17.00  0.3814      8737.5    3420.4
```

5.7 Re16fII Clean 200x200

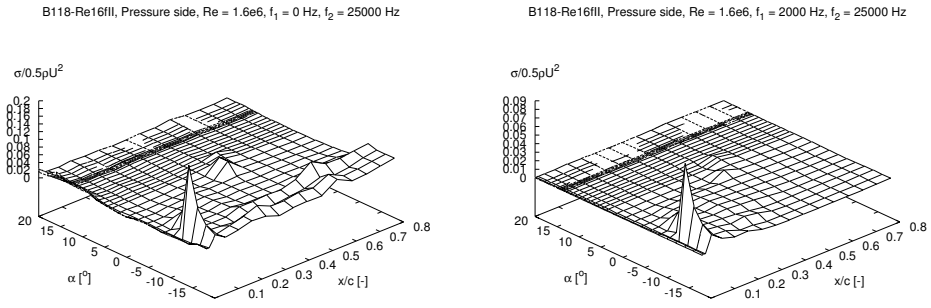

Figure 271: Pressure standard deviations, σ

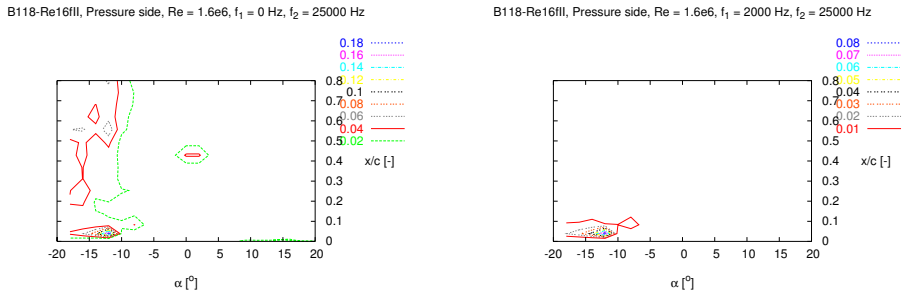

Figure 272: Contours of σ

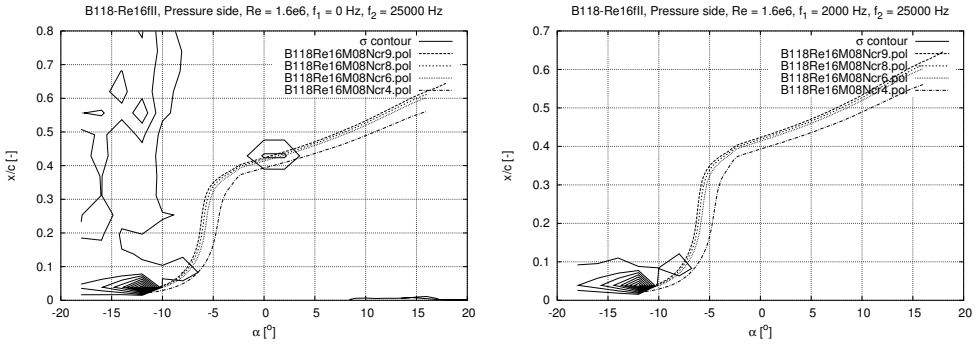

Figure 273: Contours of σ and XFoil data

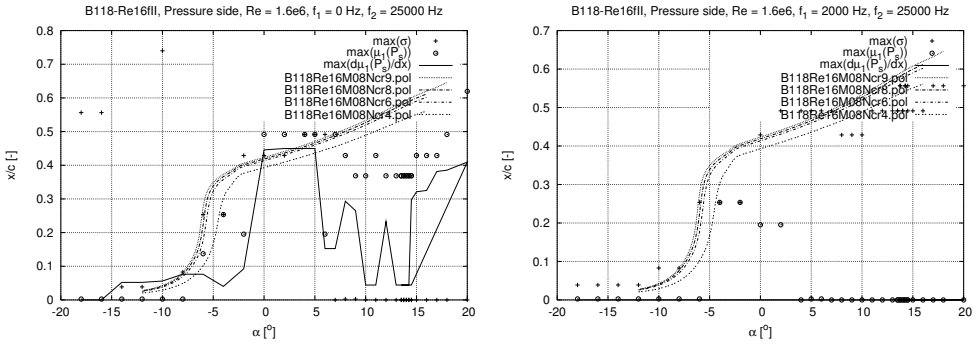

Figure 274: Transition detection

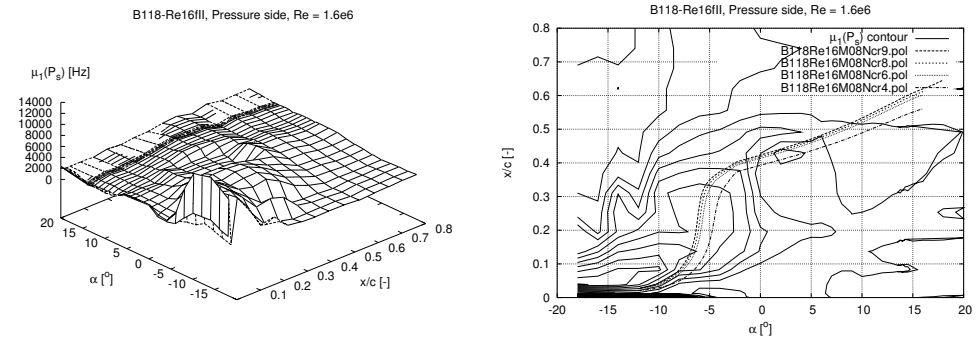

Figure 275: Fourier transform mean, $\mu_1(P_s)$

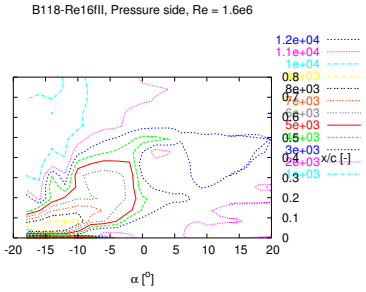

Figure 276: Contours of $\mu_1(P_s)$

```
B118-Re16fII
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     74880.2   10371.0
-16.00  0.0000     65028.9   11731.4
-14.00  0.0522     57538.9   12881.5
-12.00  0.0522     52744.8   12526.8
-10.00  0.0562     68009.0   12168.0
 -8.00  0.0763     53475.4    8744.3
 -6.00  0.0763     53784.1    6895.3
 -4.00  0.0402     45173.9    6469.6
 -2.00  0.0923     32688.3    5804.7
  0.00  0.4457     18893.7    4383.7
  2.00  0.4497     29242.5    4301.9
  4.00  0.4497     22514.1    3996.1
  5.00  0.4497     15617.5    3605.3
  6.00  0.1526     13621.8    3357.1
  7.00  0.1526     11733.0    3515.5
  8.00  0.2931      9736.2    3796.2
  9.00  0.2650     11180.1    3912.0
 10.00  0.0442     11125.0    3677.6
 11.00  0.0442      9884.8    3494.1
 12.00  0.2329      9056.5    3462.8
 13.00  0.0442      9156.0    3433.8
 13.50  0.0442      9433.2    3384.8
 13.75  0.0442      8732.4    3327.4
 14.00  0.0442     10349.1    3362.7
 14.25  0.0442      9797.0    3339.4
 14.50  0.2971      8142.8    3310.8
 15.00  0.3212      8273.2    3340.8
 16.00  0.3252      8610.9    3391.4
 17.00  0.3814      8813.2    3402.6
 18.00  0.3855     10892.7    3269.3
 20.00  0.4095      6428.8    3022.5
 14.50  0.0442      9529.7    3348.9
 14.25  0.0442      9447.5    3372.1
 14.00  0.0442      9207.8    3378.8
 13.75  0.0442      9242.7    3396.3
 13.50  0.0442     10195.7    3467.9
```

5.8 Re16g ZZ90 x/c=5% suc. x/c=10% press. 200x200

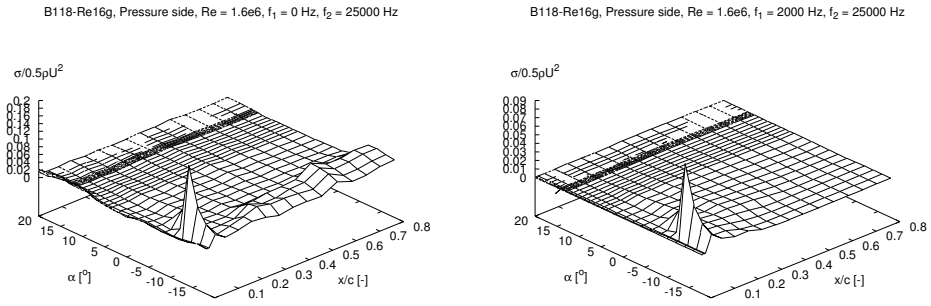

Figure 277: Pressure standard deviations, σ

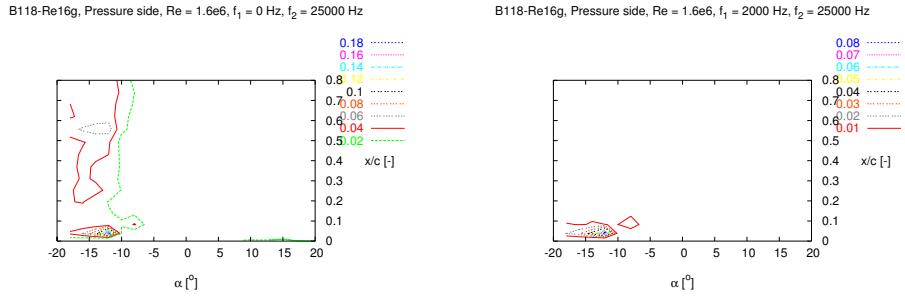

Figure 278: Contours of σ

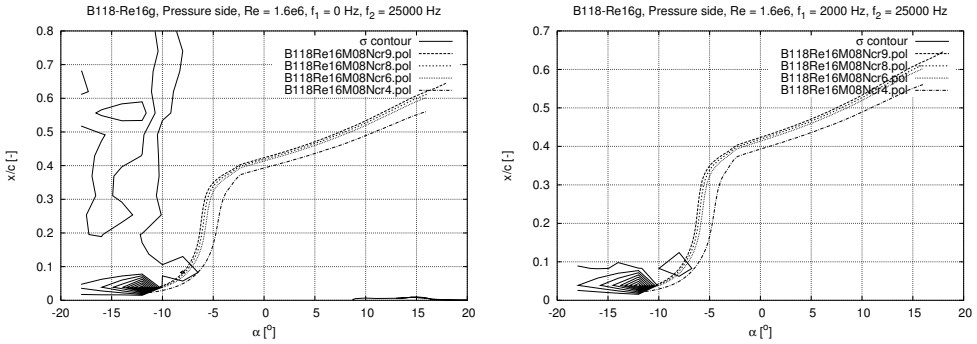

Figure 279: Contours of σ and XFoil data

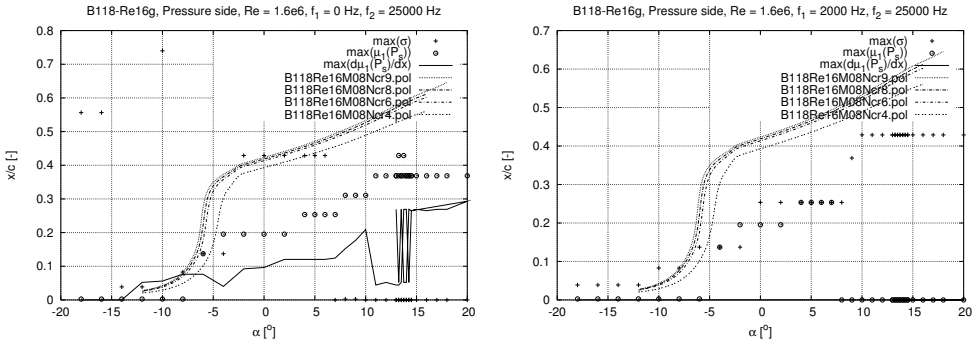

Figure 280: Transition detection

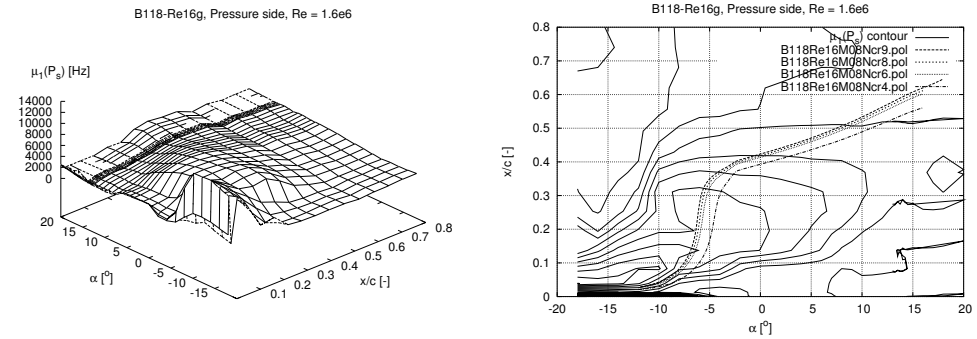

Figure 281: Fourier transform mean, $\mu_1(P_s)$

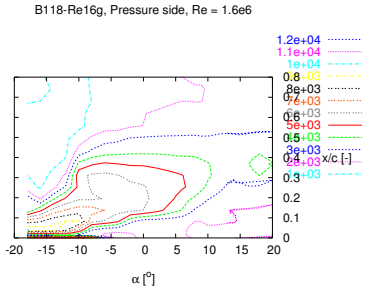

Figure 282: Contours of $\mu_1(P_s)$

```
B118-Re16g
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     72430.7   10765.4
-16.00  0.0000     61050.0   11496.7
-14.00  0.0000     53661.2   12218.3
-12.00  0.0522     51592.3   12092.9
-10.00  0.0562     65075.0   12015.8
 -8.00  0.0763     49591.3    8664.8
 -6.00  0.0763     52644.4    6970.1
 -4.00  0.0402     47250.7    6460.3
 -2.00  0.0923     44378.7    6418.5
  0.00  0.0964     43051.1    6170.6
  2.00  0.1205     37155.8    5784.5
  4.00  0.1205     30206.5    5467.8
  5.00  0.1205     26460.2    5304.4
  6.00  0.1205     23228.5    5113.2
  7.00  0.1245     19625.3    4898.5
  8.00  0.1526     16419.7    4738.0
  9.00  0.1767     14852.5    4505.9
 10.00  0.2088     11494.6    4162.6
 11.00  0.0442     10395.4    3878.9
 12.00  0.0522      9306.4    3755.9
 13.00  0.0442      9102.6    3649.4
 13.25  0.0442      8919.5    3606.5
 13.50  0.0522      8259.8    3594.7
 13.75  0.2690      8575.7    3630.6
 14.00  0.2690      8136.2    3528.1
 14.25  0.0522      8259.0    3562.4
 14.50  0.2650      8422.3    3583.0
 15.00  0.2690      9462.9    3677.1
 16.00  0.2650     11761.9    3914.7
 17.00  0.2690     13957.2    4134.9
 18.00  0.2690     15797.7    4255.7
 20.00  0.2931     19195.0    4040.0
 14.50  0.2650      8894.6    3605.4
 14.25  0.2690      8359.4    3592.7
 14.00  0.0522      8608.1    3545.1
 13.75  0.0522      8421.5    3548.0
 13.50  0.2690      8295.5    3589.7
 13.25  0.0522      8447.9    3584.9
 13.00  0.2690      8373.1    3634.0
```

5.9 Re16h LER. ZZ 2% 200x200

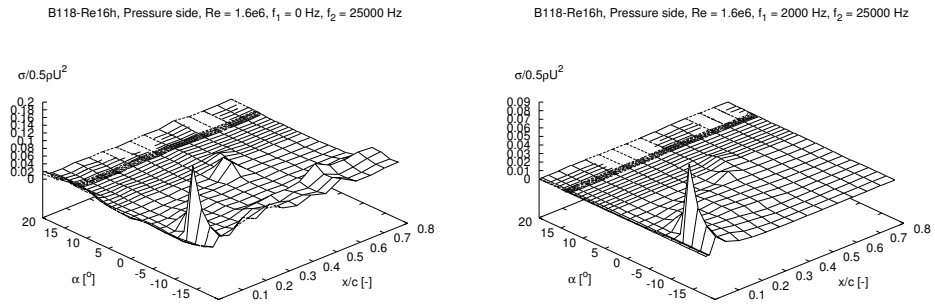

Figure 283: Pressure standard deviations, σ

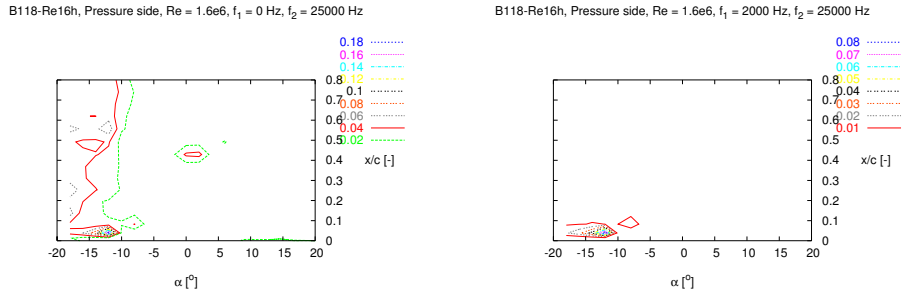

Figure 284: Contours of σ

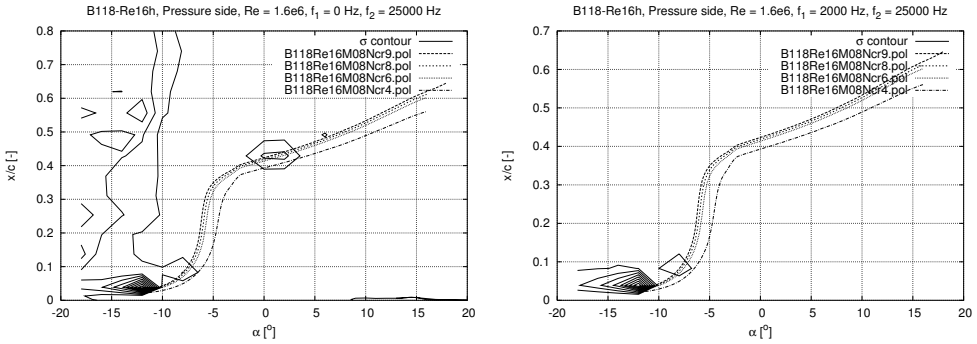

Figure 285: Contours of σ and XFoil data

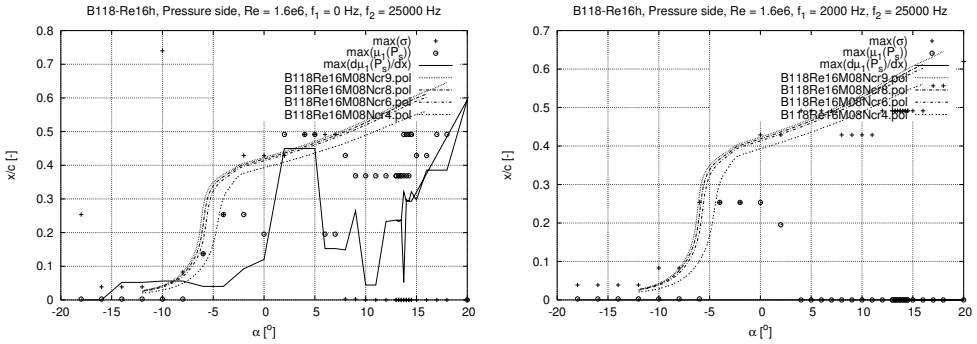

Figure 286: Transition detection

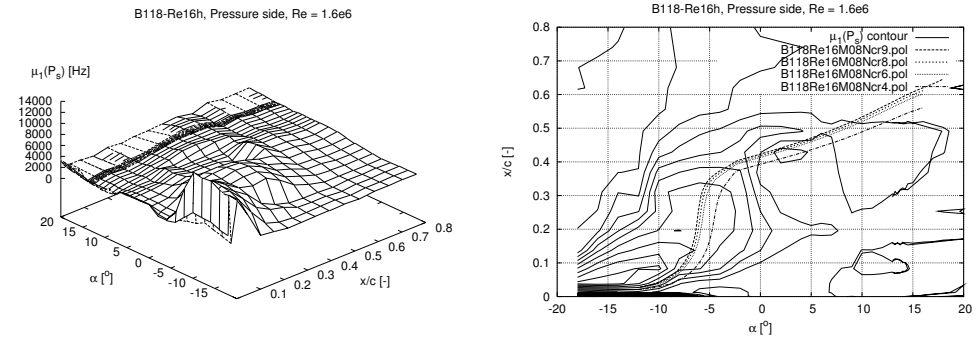

Figure 287: Fourier transform mean, $\mu_1(P_s)$

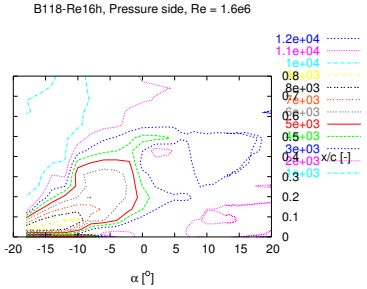

Figure 288: Contours of $\mu_1(P_s)$

```
B118-Re16h
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     62263.5   10556.1
-16.00  0.0000     63048.1   11154.3
-14.00  0.0522     55183.2   12050.3
-12.00  0.0522     52871.2   11897.2
-10.00  0.0562     67041.5   12211.9
 -8.00  0.0562     50607.3    8625.0
 -6.00  0.0402     52586.2    6811.1
 -4.00  0.0402     45513.2    6559.8
 -2.00  0.0923     32514.5    5837.6
  0.00  0.1205     21099.1    4498.6
  2.00  0.4497     29633.3    4343.7
  4.00  0.4497     24189.4    4067.6
  5.00  0.4497     16725.0    3654.8
  6.00  0.1526     13119.8    3284.5
  7.00  0.1526     14022.0    3270.7
  8.00  0.1486      8188.9    3689.6
  9.00  0.2650     10864.4    3880.3
 10.00  0.0442      9777.8    3736.1
 11.00  0.0442      9942.5    3511.1
 12.00  0.2329      8750.6    3428.3
 13.00  0.2369      8122.6    3400.5
 13.25  0.2369      8153.0    3383.7
 13.50  0.2369      8029.8    3397.0
 13.75  0.0522      7022.0    3350.2
 14.00  0.2971      7182.7    3327.2
 14.25  0.2931      7654.8    3335.3
 14.50  0.3212      7046.0    3355.6
 15.00  0.2971      7830.9    3388.6
 16.00  0.3855      8163.0    3449.2
 17.00  0.3855     10041.0    3232.6
 18.00  0.3855      7486.5    3117.1
 20.00  0.5942      9563.7    3404.7
 14.50  0.2931      8394.4    3469.6
 14.25  0.2931      7453.1    3382.9
 14.00  0.2931      7285.3    3372.7
 13.75  0.3212      6860.7    3360.3
 13.50  0.2369      8345.2    3365.3
 13.25  0.2329      7496.7    3388.2
 13.00  0.2369      8574.4    3426.2
```

5.10 Re16i Trip wire. Bump tape 0,1 2% 200x200

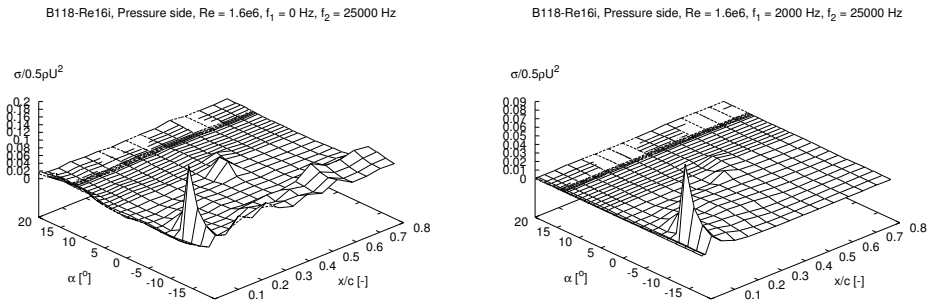

Figure 289: Pressure standard deviations, σ

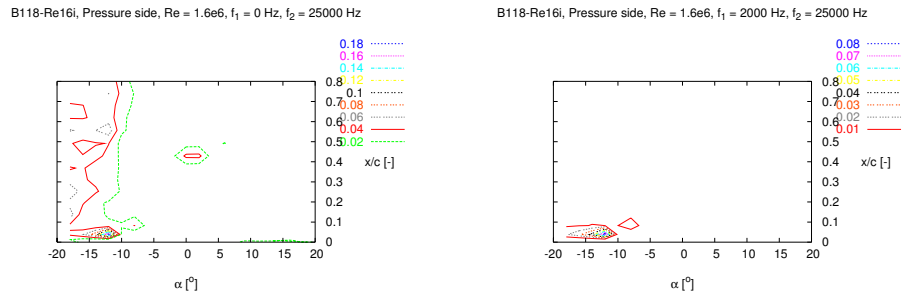

Figure 290: Contours of σ

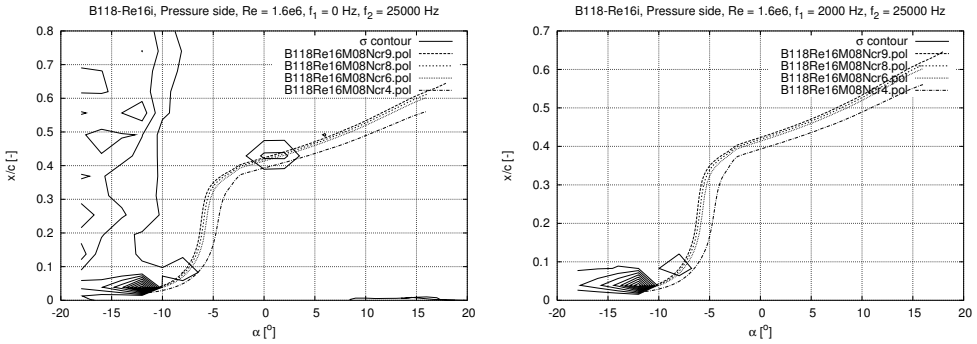

Figure 291: Contours of σ and XFoil data

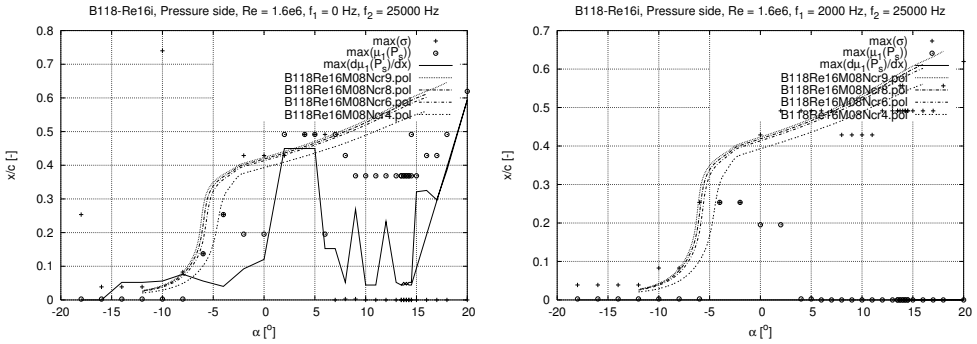

Figure 292: Transition detection

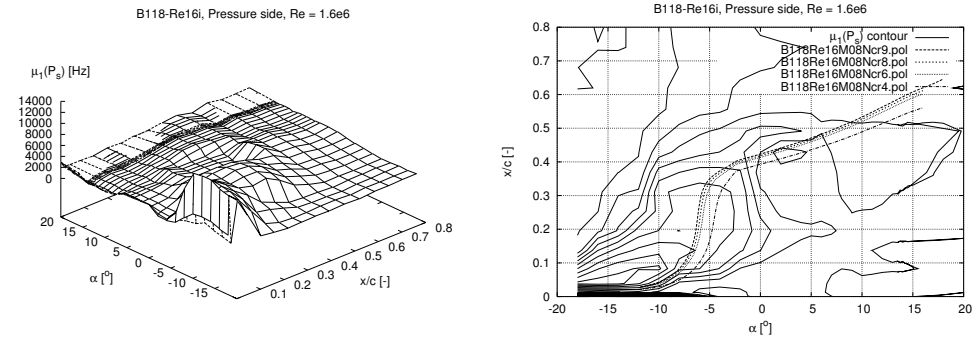

Figure 293: Fourier transform mean, $\mu_1(P_s)$

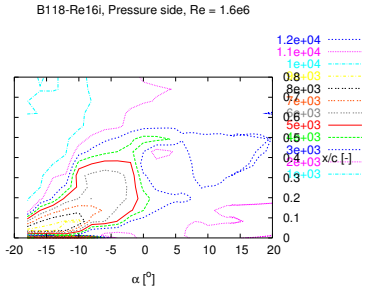

Figure 294: Contours of $\mu_1(P_s)$

```
B118-Re16i
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     60814.5   10873.2
-16.00  0.0000     61783.2   11306.2
-14.00  0.0522     55276.4   12279.2
-12.00  0.0522     52582.1   12266.2
-10.00  0.0562     67154.0   12005.4
 -8.00  0.0763     54232.9    8597.2
 -6.00  0.0562     52068.2    6836.5
 -4.00  0.0402     44394.0    6537.2
 -2.00  0.0923     32516.3    5783.8
  0.00  0.1205     20713.9    4440.9
  2.00  0.4497     30046.2    4329.4
  4.00  0.4497     23141.2    4012.4
  5.00  0.4497     16094.8    3615.8
  6.00  0.1526     15093.6    3426.2
  7.00  0.1526     12274.0    3441.7
  8.00  0.0522      8492.5    3728.7
  9.00  0.2690     11237.8    3922.3
 10.00  0.0442     10654.0    3733.0
 11.00  0.0442      9433.2    3489.3
 12.00  0.2329      9539.8    3490.1
 13.00  0.0522      8259.4    3453.4
 13.50  0.0442      9307.4    3452.1
 13.75  0.0522      8384.0    3395.8
 14.00  0.0442      9494.0    3378.6
 14.25  0.0522      8174.0    3365.8
 14.50  0.0522      7945.4    3302.8
 15.00  0.3212      7723.0    3296.6
 16.00  0.3252      8484.9    3396.1
 17.00  0.2971      8098.0    3381.7
 18.00  0.3855     10133.6    3296.5
 20.00  0.5942      6995.8    3046.9
 14.50  0.0442      7878.9    3403.9
 14.25  0.0442      8026.4    3350.4
 14.00  0.0522      8251.3    3387.0
 13.75  0.0442      9242.1    3398.1
 13.50  0.0442      9143.5    3431.8
```

5.11 Re16j Clean 100x100

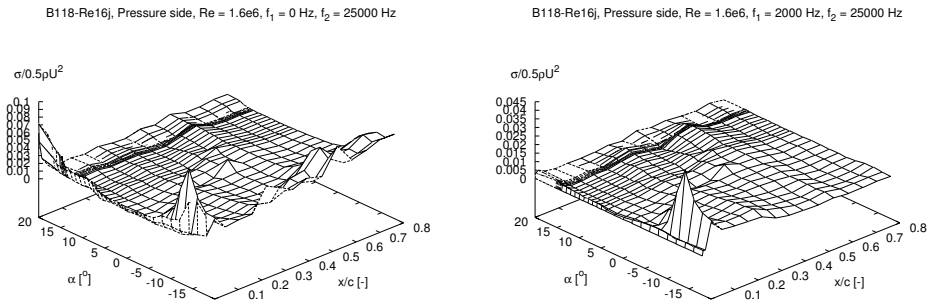

Figure 295: Pressure standard deviations, σ

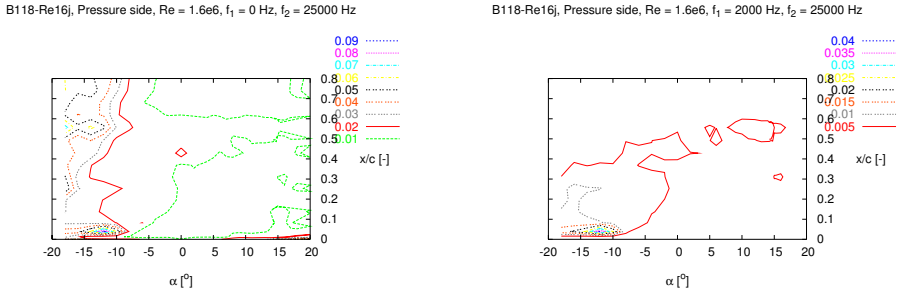

Figure 296: Contours of σ

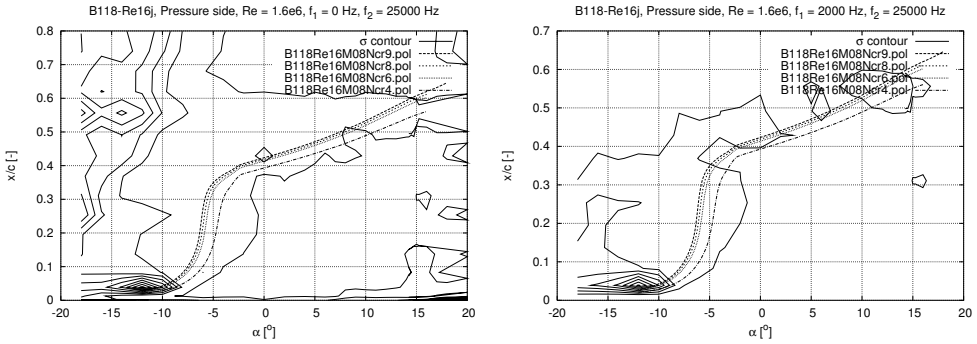

Figure 297: Contours of σ and XFoil data

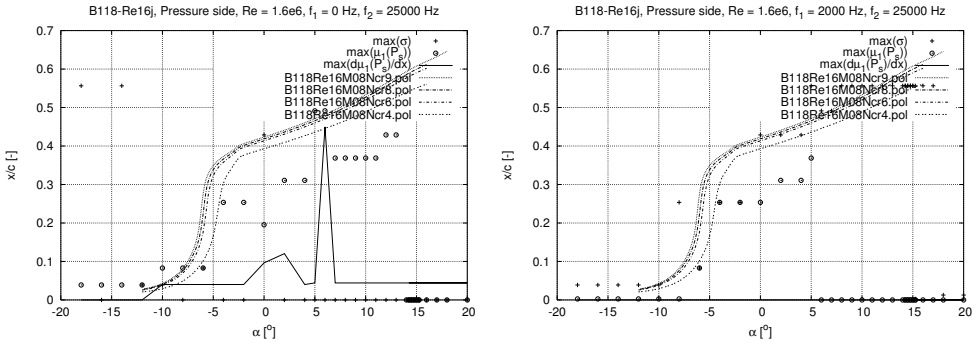

Figure 298: Transition detection

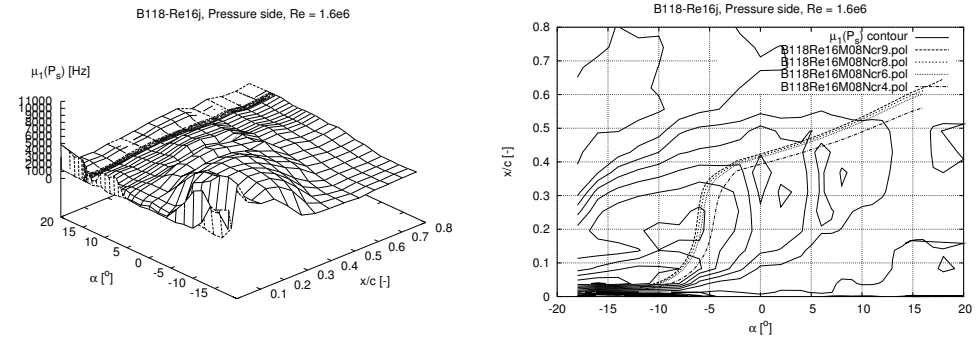

Figure 299: Fourier transform mean, $\mu_1(P_s)$

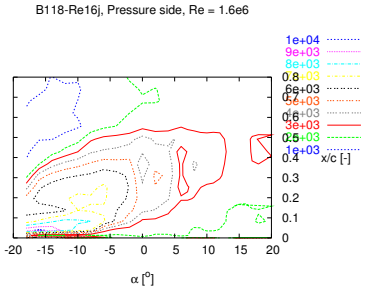

Figure 300: Contours of $\mu_1(P_s)$

```
B118-Re16j
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     63673.4    9725.5
-16.00  0.0000     83867.5   10140.0
-14.00  0.0000     83590.5    9790.9
-12.00  0.0000     67521.4    8452.4
-10.00  0.0402     76862.3    8141.9
 -8.00  0.0402     76276.6    8005.0
 -6.00  0.0402     69504.5    7154.4
 -4.00  0.0402     51773.0    6615.2
 -2.00  0.0402     33944.8    5950.2
  0.00  0.0964     19708.2    4429.8
  2.00  0.1205     18513.7    5178.3
  4.00  0.0402     16384.1    4845.4
  5.00  0.0442     13904.3    4023.0
  6.00  0.4497     14218.1    3776.4
  7.00  0.0442     12529.5    3587.8
  8.00  0.0442     13404.4    4086.8
  9.00  0.0442     14459.7    3919.7
 10.00  0.0442     15897.0    3678.7
 11.00  0.0442     12052.7    3708.8
 12.00  0.0442     12120.1    3583.1
 13.00  0.0442     10838.0    2997.2
 14.00  0.0442      7915.6    2823.7
 14.25  0.0442      7165.9    3425.8
 14.50  0.0442      7146.0    3392.7
 14.75  0.0442      6617.2    3889.2
 15.00  0.0442      6482.1    4031.1
 15.25  0.0442      6089.4    4030.3
 16.00  0.0442      5899.1    4221.8
 17.00  0.0442      9769.5    3937.5
 18.00  0.0442      9234.6    4461.1
 20.00  0.0442      8591.3    4862.6
 15.25  0.0442      5868.1    4103.8
 15.00  0.0442      6110.3    4110.6
 14.75  0.0442      6446.6    3709.3
 14.50  0.0442      6901.2    3051.8
 14.25  0.0442      7340.1    2885.9
```

5.12 Re16k ZZ90 x/c=5% suc. x/c=10% press.

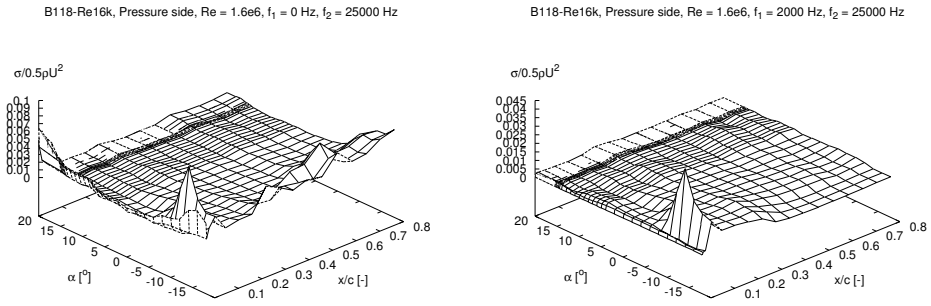

Figure 301: Pressure standard deviations, σ

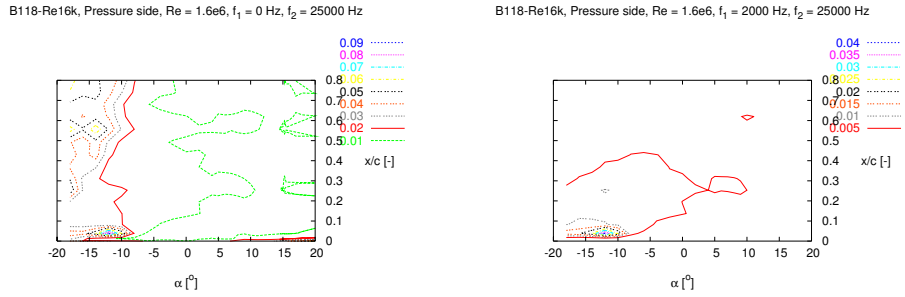

Figure 302: Contours of σ

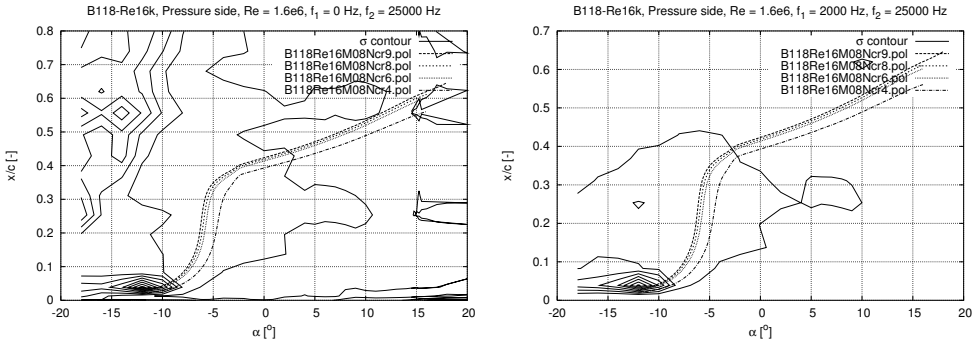

Figure 303: Contours of σ and XFoil data

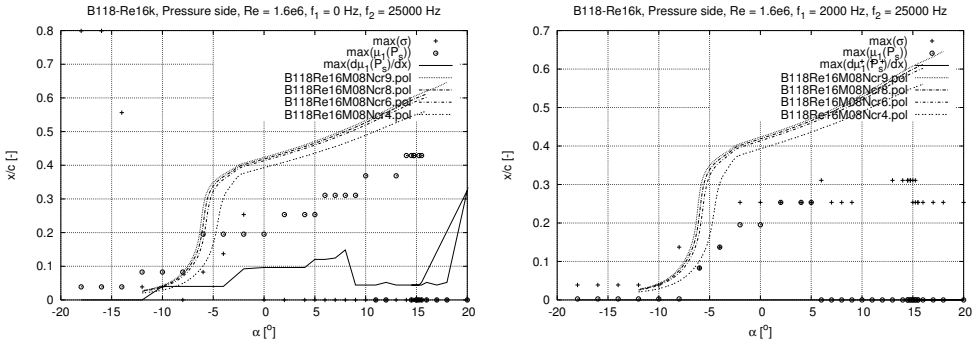

Figure 304: Transition detection

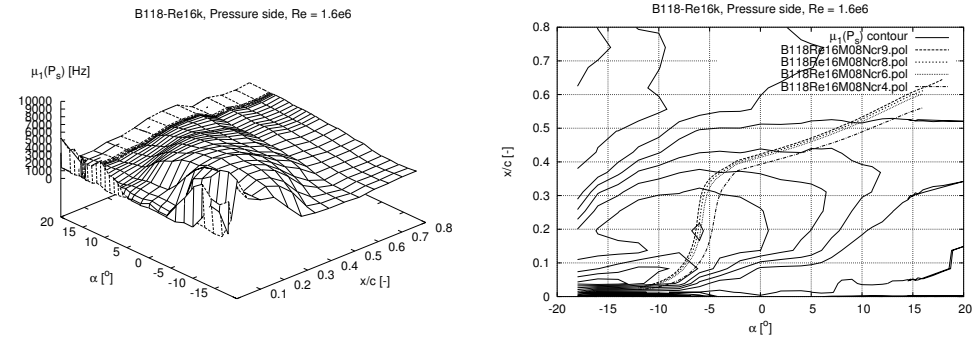

Figure 305: Fourier transform mean, $\mu_1(P_s)$

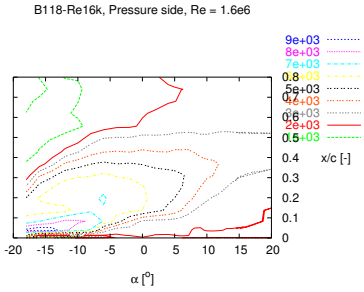

Figure 306: Contours of $\mu_1(P_s)$

```
B118-Re16k
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     52143.3    9295.0
-16.00  0.0000     81112.4    9915.4
-14.00  0.0000     78738.6    9590.2
-12.00  0.0000     64275.1    8242.9
-10.00  0.0402     76633.8    8146.3
 -8.00  0.0402     72839.1    7829.3
 -6.00  0.0402     67391.3    7095.1
 -4.00  0.0402     50754.4    6612.3
 -2.00  0.0923     39539.3    6475.1
  0.00  0.0964     40690.7    6251.5
  2.00  0.0964     33750.5    5614.6
  4.00  0.0964     27730.6    5313.2
  5.00  0.1205     25579.8    5194.3
  6.00  0.1205     22175.0    5066.1
  7.00  0.1245     18499.4    4925.5
  8.00  0.1486     14895.2    4699.3
  9.00  0.0442     14713.9    4401.3
 10.00  0.0442     15890.2    4156.1
 11.00  0.0442     12520.8    4565.8
 12.00  0.0522     10980.2    4013.2
 13.00  0.0442     12172.0    3855.8
 14.00  0.0442     11393.3    3674.4
 14.50  0.0442     12048.2    3904.7
 14.75  0.0442     10682.8    3610.2
 15.00  0.0442      9963.3    3703.5
 15.25  0.0442      9927.7    3906.6
 15.50  0.0442      9632.3    4166.9
 16.00  0.0522     10028.9    3959.2
 17.00  0.0442     10439.4    4628.1
 18.00  0.0522     10071.9    4204.7
 20.00  0.3252      8318.6    5276.9
 15.50  0.0522     10318.4    3584.1
 15.25  0.0442     10773.4    3523.7
 15.00  0.0442     10160.2    4052.2
 14.75  0.0442      9877.1    3552.8
 14.50  0.0442     11319.2    3610.6
```

5.13 Re16m Trip wire. Bump tape 0,1 2%

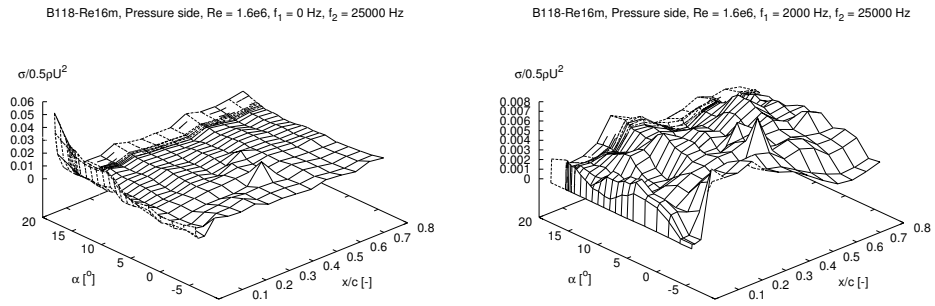

Figure 307: Pressure standard deviations, σ

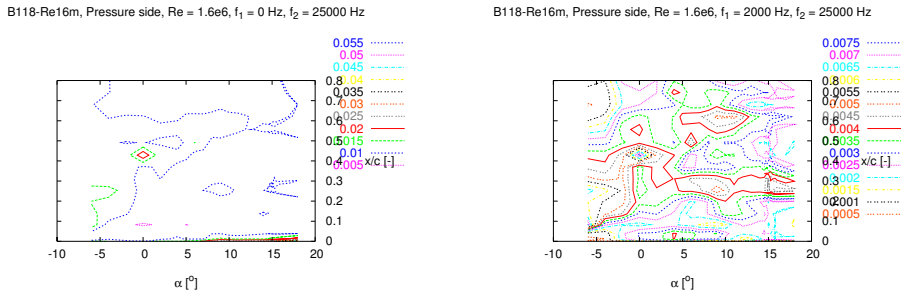

Figure 308: Contours of σ

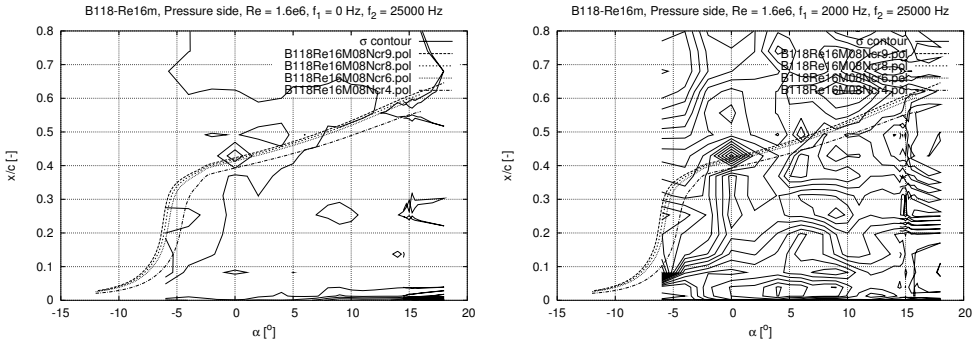

Figure 309: Contours of σ and XFoil data

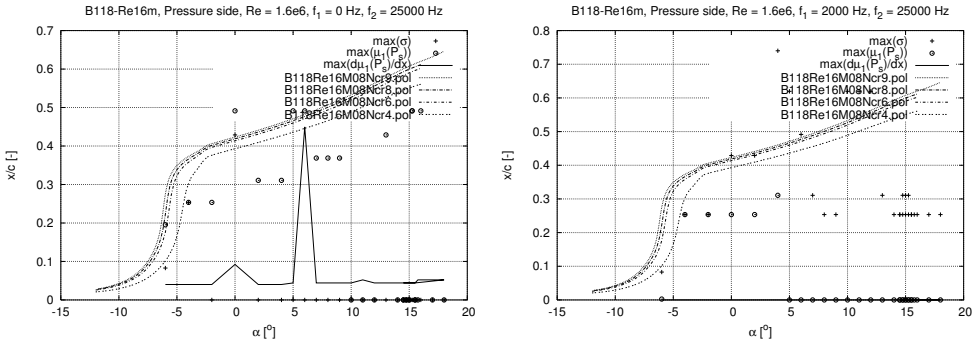

Figure 310: Transition detection

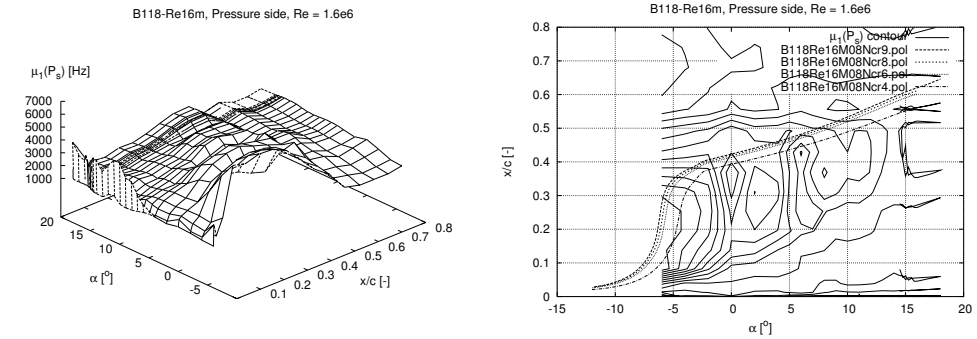

Figure 311: Fourier transform mean, $\mu_1(P_s)$

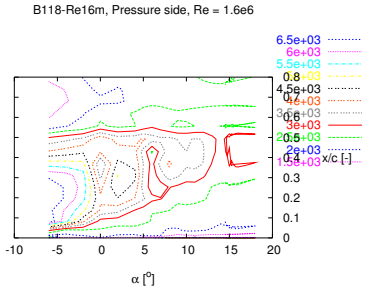

Figure 312: Contours of $\mu_1(P_s)$

```
B118-Re16m
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
 -6.00  0.0402     67327.7    6972.6
 -4.00  0.0402     51979.0    6418.0
 -2.00  0.0402     32127.2    5813.9
  0.00  0.0923     16078.6    4415.5
  2.00  0.0402     16893.9    5009.2
  4.00  0.0402     15490.7    4641.4
  5.00  0.0442     13626.0    4062.2
  6.00  0.4497     13597.0    3739.7
  7.00  0.0442     12861.3    3679.8
  8.00  0.0442     13772.9    4067.8
  9.00  0.0442     14341.1    3794.1
 10.00  0.0442     15742.2    4341.6
 11.00  0.0522     10959.7    4310.5
 12.00  0.0442     10725.6    3702.4
 13.00  0.0442     13190.6    3157.3
 14.00  0.0442     11233.8    3757.5
 14.50  0.0442     11307.9    3585.2
 14.75  0.0442     10560.7    3407.0
 15.00  0.0442     10163.4    3445.8
 15.25  0.0442     10001.0    3216.3
 15.50  0.0442      9299.8    3441.5
 15.75  0.0522      9777.3    3699.1
 16.00  0.0522     10043.3    3442.9
 17.00  0.0522     10022.1    3475.9
 18.00  0.0522     10140.7    4253.1
 15.50  0.0442      9716.1    3364.7
 15.25  0.0442      9594.8    3343.9
 15.00  0.0442     10502.2    3307.2
 14.75  0.0442     11079.3    3547.2
 14.50  0.0442     10498.8    3785.8
```

5.14 Re3a Clean -

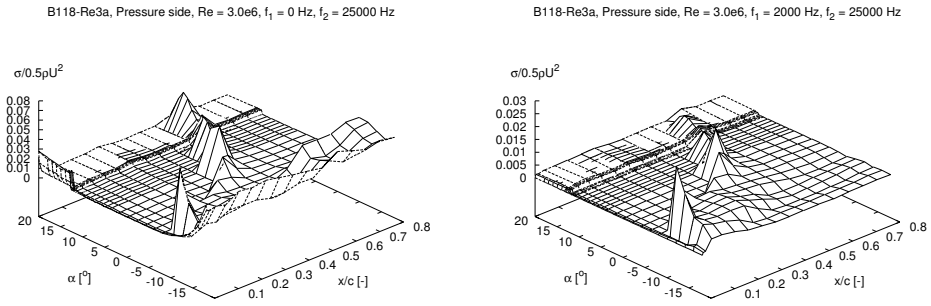

Figure 313: Pressure standard deviations, σ

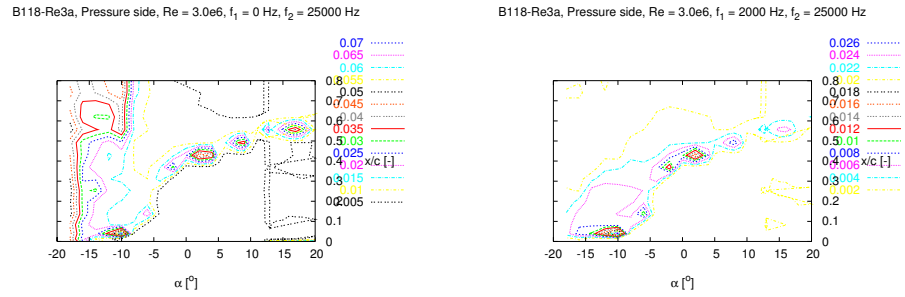

Figure 314: Contours of σ

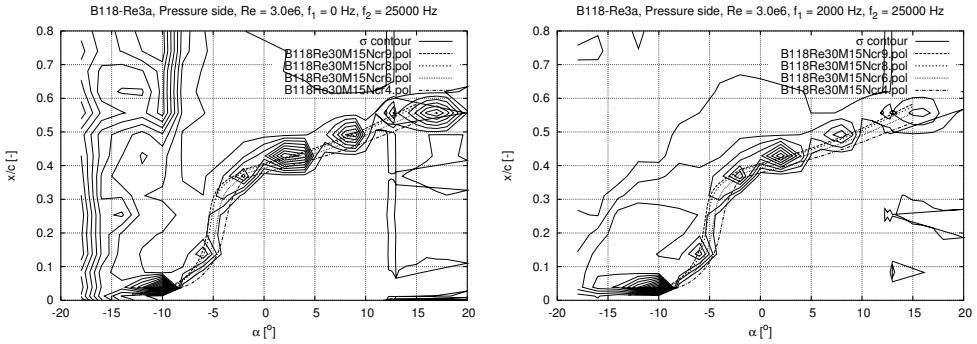

Figure 315: Contours of σ and XFoil data

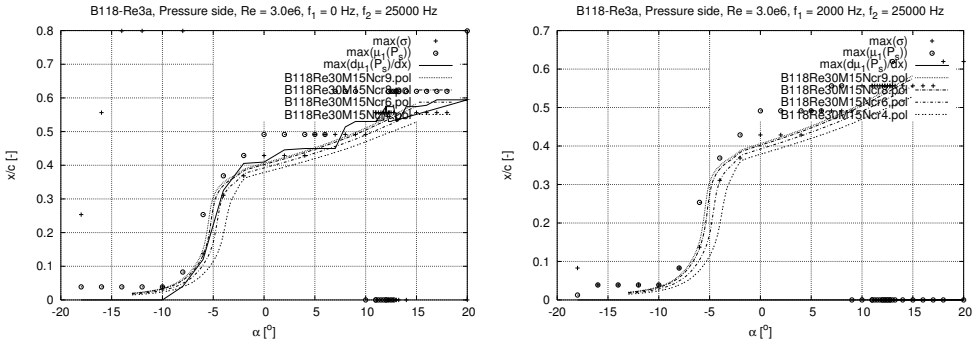

Figure 316: Transition detection

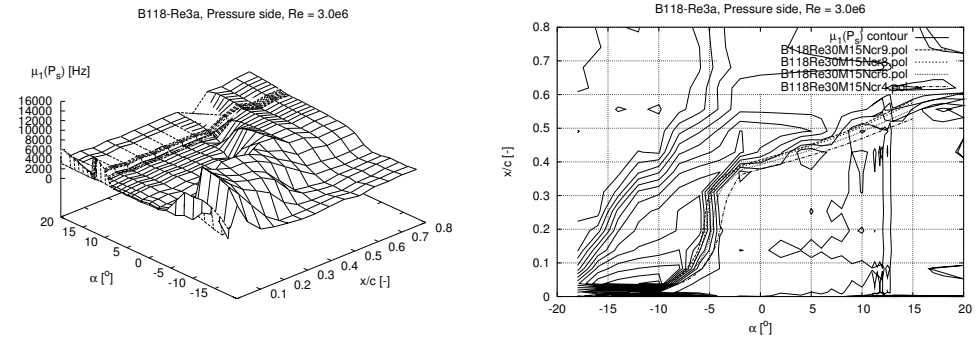

Figure 317: Fourier transform mean, $\mu_1(P_s)$

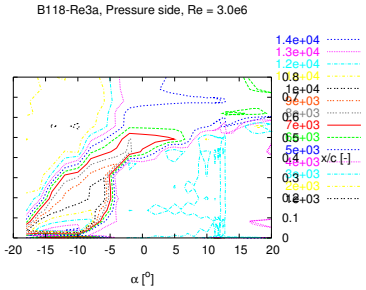

Figure 318: Contours of $\mu_1(P_s)$

```
B118-Re3a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     44858.2    9760.6
-16.00  0.0000    101762.7   12713.9
-14.00  0.0000    105828.6   13529.0
-12.00  0.0000    105754.6   13992.9
-10.00  0.0000    109005.1   14366.3
 -8.00  0.0402     95091.6   12247.2
 -6.00  0.1205     49436.8   10537.0
 -4.00  0.3252     67575.9    9033.2
 -2.00  0.4055     65365.5    8233.4
  0.00  0.4095     44200.9    7768.5
  2.00  0.4457     36527.5    7572.0
  4.00  0.4497     52807.5    7236.8
  5.00  0.4497     52965.5    6987.2
  6.00  0.4497     40879.4    6500.7
  7.00  0.4497     30200.2    5830.9
  8.00  0.5139     20931.6    5849.8
  9.00  0.5300     35743.1    5856.2
 10.00  0.5300     40931.3    6032.4
 11.00  0.5300     32168.4    6926.8
 12.00  0.5742     23814.3    7388.6
 12.25  0.5742     26429.7    7543.9
 12.50  0.5742     27698.7    7632.6
 12.75  0.5742     30900.6    7680.0
 13.00  0.5340     25189.6    6035.7
 13.25  0.5340     23781.9    6050.9
 14.00  0.5742     22252.1    6137.6
 15.00  0.5742     27770.3    6226.0
 16.00  0.5782     36538.2    6264.3
 17.00  0.5942     46187.5    6328.8
 18.00  0.5942     50273.5    6297.9
 20.00  0.5942     39070.5    6362.7
 13.00  0.5340     25780.4    6140.2
 12.75  0.5340     26834.7    6069.2
 12.50  0.5300     27880.6    6014.2
 12.25  0.5300     28963.4    5980.4
 12.00  0.5742     24600.5    7526.2
 11.75  0.5340     22931.6    7355.6
 11.50  0.5340     26646.4    7230.2
 11.25  0.5340     27774.5    7098.7
 11.00  0.5300     31933.4    6962.0
```

5.15 Re3b ZZ90 x/c=5% suc. x/c=10% press. -

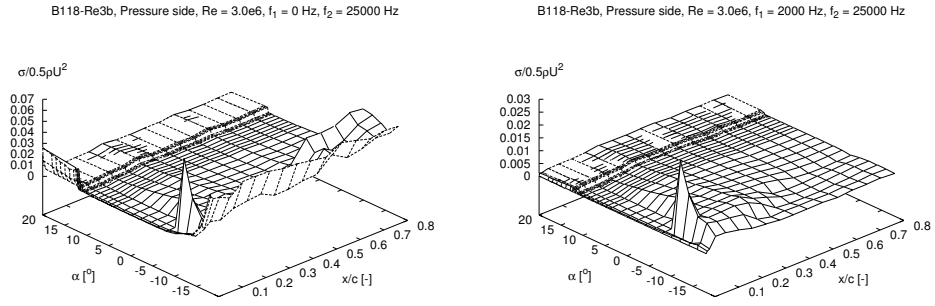

Figure 319: Pressure standard deviations, σ

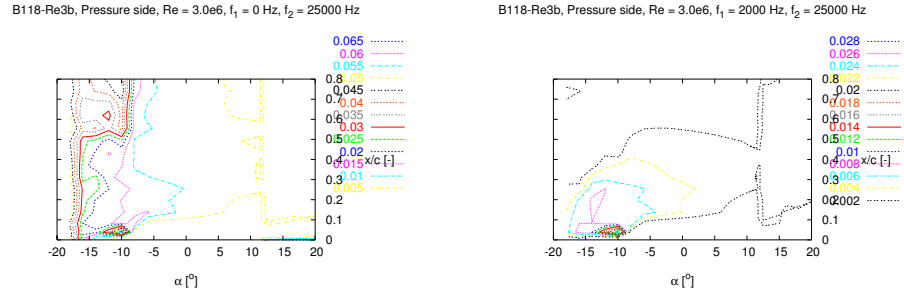

Figure 320: Contours of σ

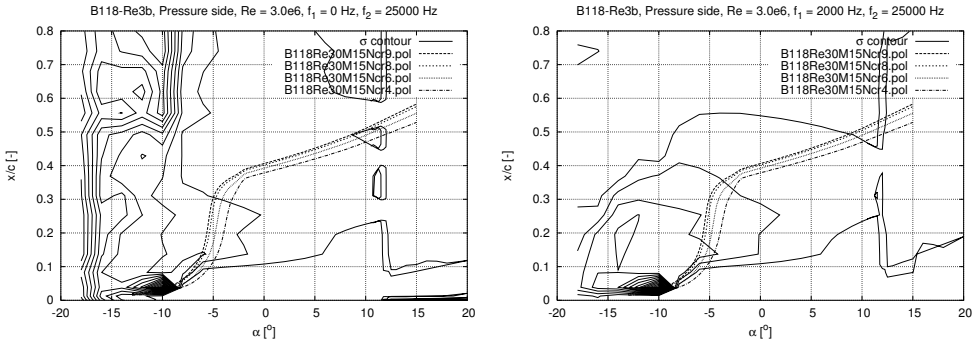

Figure 321: Contours of σ and XFoil data

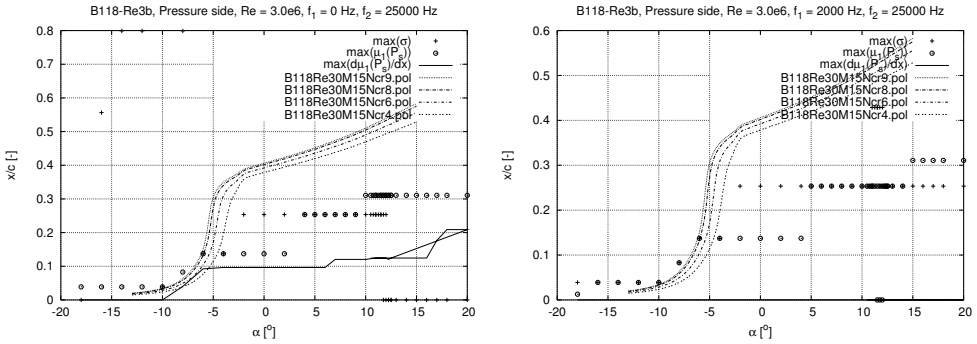

Figure 322: Transition detection

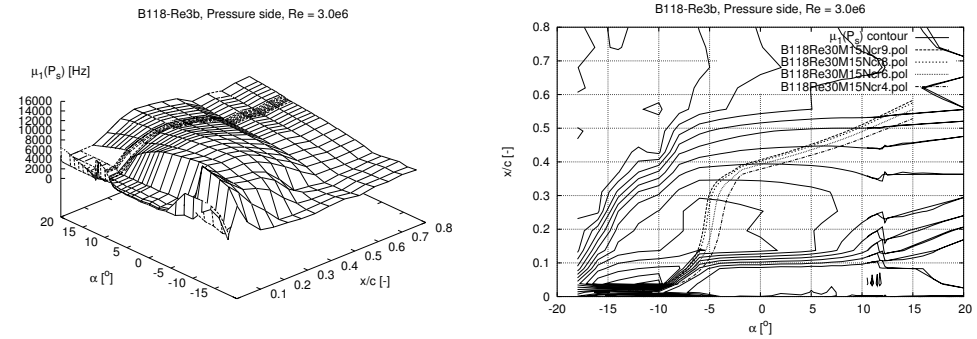

Figure 323: Fourier transform mean, $\mu_1(P_s)$

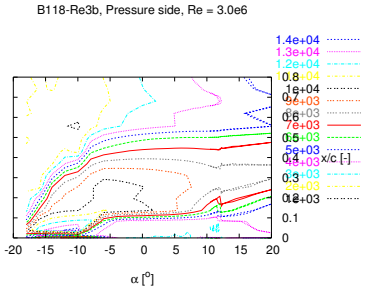

Figure 324: Contours of $\mu_1(P_s)$

```
B118-Re3b
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     48105.0    9627.2
-16.00  0.0000     97722.9   12754.6
-14.00  0.0000     96547.1   13384.7
-12.00  0.0000    105273.7   14009.3
-10.00  0.0000    107934.0   14542.9
 -8.00  0.0402     93981.2   12241.9
 -6.00  0.0923     77382.3   11033.0
 -4.00  0.0964     83754.0   10917.8
 -2.00  0.0964     86089.8   10646.7
  0.00  0.0964     80660.9   10308.4
  2.00  0.0964     79497.4    9931.9
  4.00  0.0964     73571.7    9566.7
  5.00  0.0964     71883.2    9451.3
  6.00  0.0964     65152.8    9279.8
  7.00  0.1205     62652.7    9111.4
  8.00  0.1205     56150.7    8922.3
  9.00  0.1205     51995.8    8697.9
 10.00  0.1205     44974.4    8539.0
 11.00  0.1245     40068.8    8388.4
 11.50  0.1245     35477.2    8338.3
 11.75  0.1245     35781.1    8298.1
 12.00  0.1245     33104.7    8272.9
 12.25  0.1205     41416.0    8571.8
 12.50  0.1245     35255.4    8425.1
 13.00  0.1245     34671.3    8418.8
 14.00  0.1245     32201.0    8440.0
 15.00  0.1245     28958.2    8374.6
 16.00  0.1245     25979.0    8345.9
 17.00  0.1767     24844.9    8340.9
 18.00  0.2088     26587.0    8302.2
 20.00  0.2088     28198.1    8246.3
 12.50  0.1245     35558.5    8461.4
 12.25  0.1245     35874.7    8465.5
 12.00  0.1245     35490.3    8437.7
 11.75  0.1245     35122.4    8376.5
 11.50  0.1245     37245.3    8342.5
 11.25  0.1245     37022.3    8376.5
 11.00  0.1245     40070.1    8388.2
 10.75  0.1245     40198.4    8438.7
 10.50  0.1245     43543.8    8475.3
```

5.16 Re3c LM standard LER. ZZ 2% -

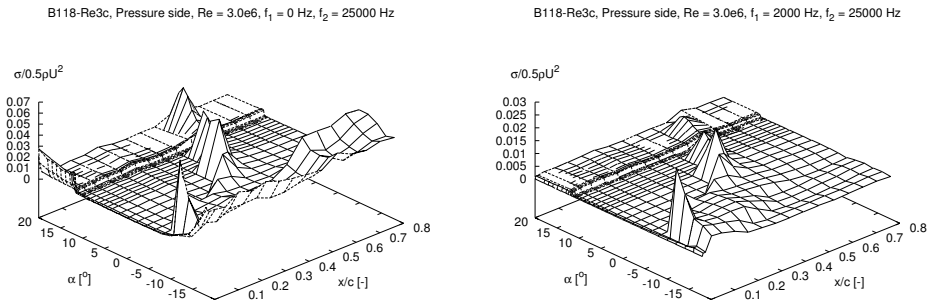

Figure 325: Pressure standard deviations, σ

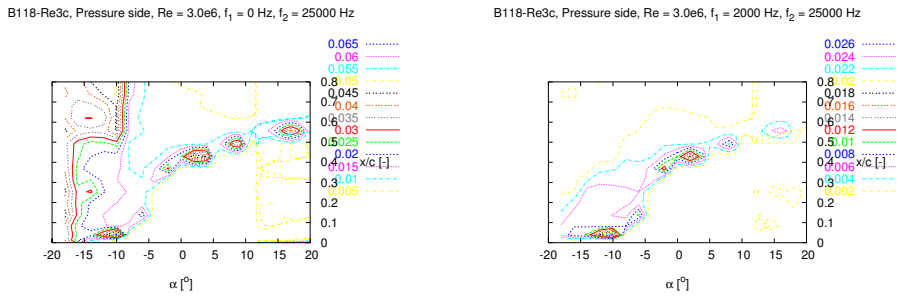

Figure 326: Contours of σ

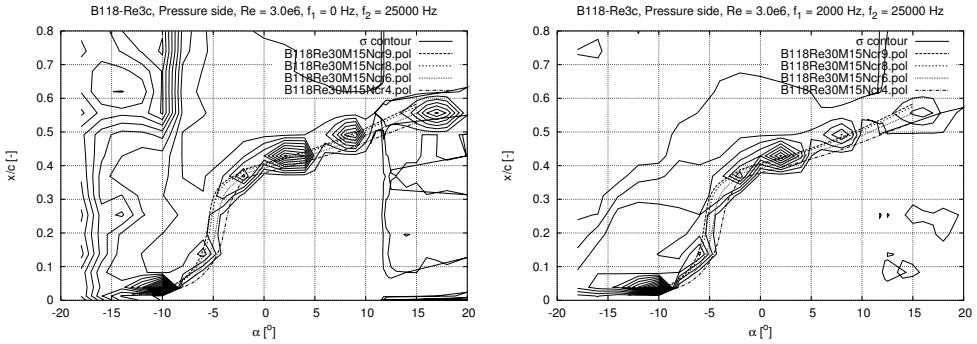

Figure 327: Contours of σ and XFoil data

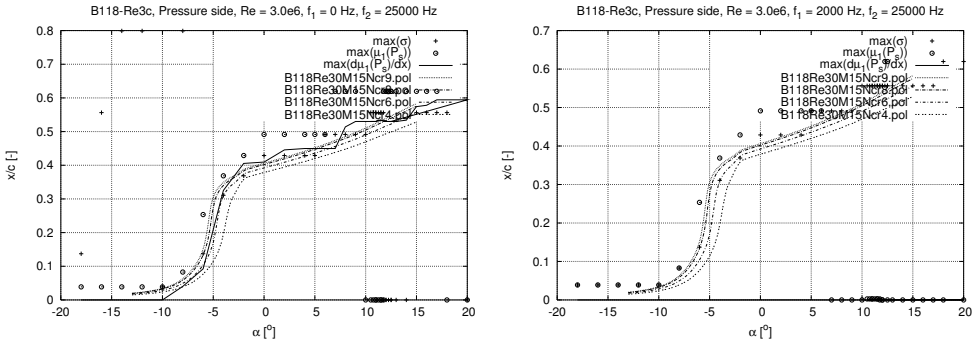

Figure 328: Transition detection

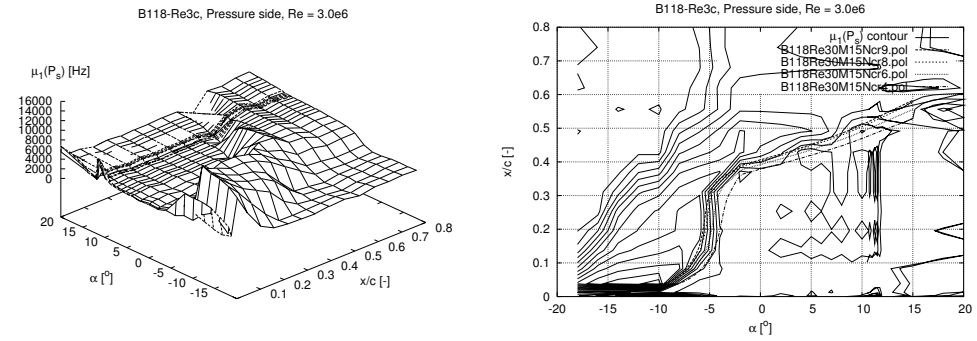

Figure 329: Fourier transform mean, $\mu_1(P_s)$

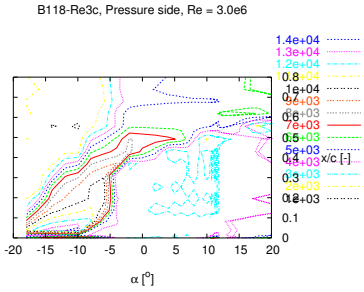

Figure 330: Contours of $\mu_1(P_s)$

```
B118-Re3c
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     80606.9   11279.7
-16.00  0.0000    102778.8   12764.0
-14.00  0.0000    106547.6   13522.4
-12.00  0.0000    106618.5   13848.9
-10.00  0.0000    113260.1   14627.1
 -8.00  0.0402     95959.5   12245.0
 -6.00  0.0923     62100.1   10536.7
 -4.00  0.3252     67894.9    9093.3
 -2.00  0.4055     65814.6    8286.5
  0.00  0.4095     44338.1    7780.3
  2.00  0.4457     36070.6    7571.9
  4.00  0.4497     52517.4    7244.7
  5.00  0.4497     53646.3    7023.4
  6.00  0.4497     43108.9    6582.3
  7.00  0.4497     33007.2    5889.6
  8.00  0.5139     20580.1    5892.0
  9.00  0.5300     35655.8    5892.6
 10.00  0.5300     41448.5    6274.6
 11.00  0.5300     33037.3    7260.4
 11.50  0.5340     26464.7    7546.7
 11.75  0.5340     25868.1    7572.7
 12.00  0.5300     36578.3    6105.7
 12.50  0.5300     31681.5    6118.1
 13.00  0.5300     28131.4    6144.6
 14.00  0.5340     21777.2    6248.5
 15.00  0.5742     26109.5    6285.5
 16.00  0.5782     35328.1    6344.0
 17.00  0.5942     45466.5    6369.5
 18.00  0.5942     50208.1    6346.5
 20.00  0.5942     41041.5    6706.9
 12.50  0.5300     32414.9    6155.1
 12.25  0.5300     33406.4    6099.7
 12.00  0.5300     34018.8    6004.4
 11.75  0.5300     35622.0    6033.8
 11.50  0.5340     28073.4    7588.7
 11.25  0.5340     28910.0    7496.0
 11.00  0.5300     32940.0    7293.3
 10.75  0.5300     34674.0    7130.4
 10.50  0.5300     38397.0    6944.5
```

5.17 Re3d Trip wire. Bump tape 2% -

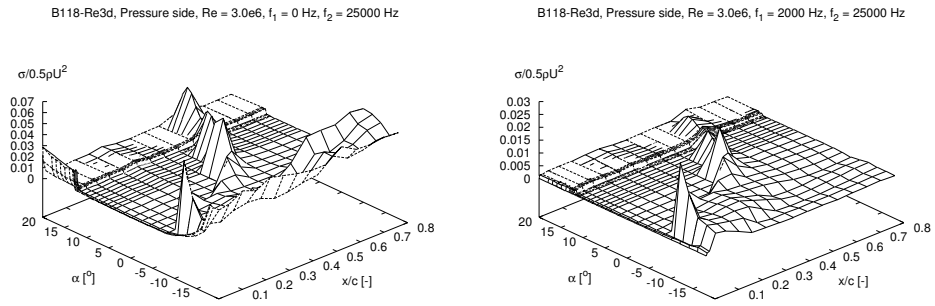

Figure 331: Pressure standard deviations, σ

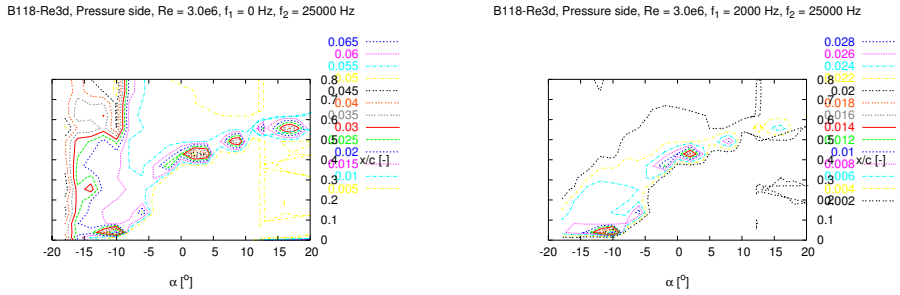

Figure 332: Contours of σ

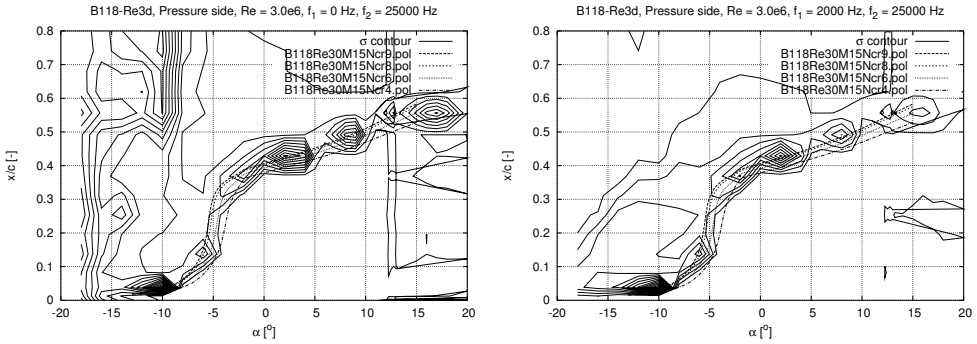

Figure 333: Contours of σ and XFoil data

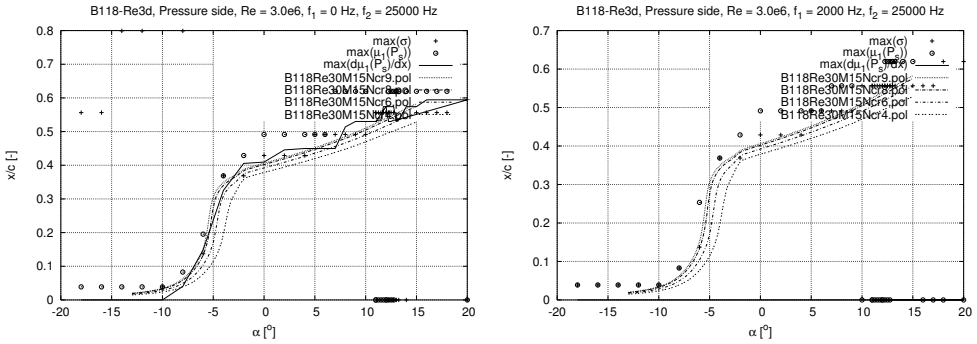

Figure 334: Transition detection

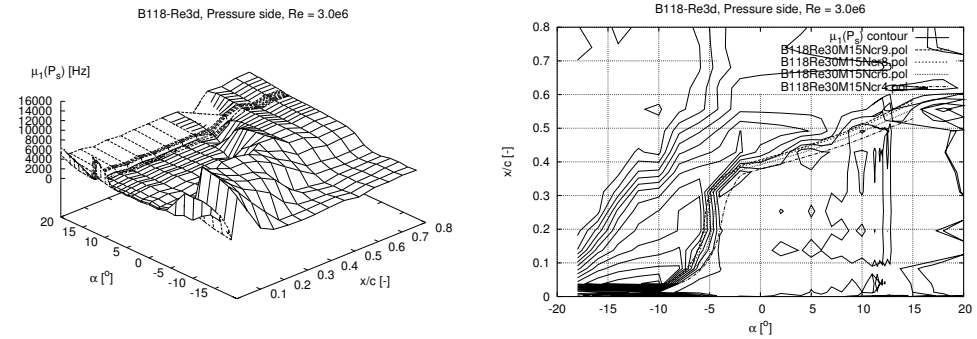

Figure 335: Fourier transform mean, $\mu_1(P_s)$

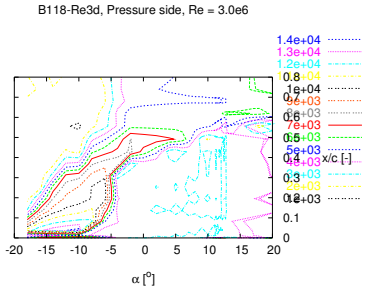

Figure 336: Contours of $\mu_1(P_s)$

```
B118-Re3d
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     91643.3   11473.1
-16.00  0.0000    100160.7   12768.4
-14.00  0.0000    105253.3   13498.5
-12.00  0.0000    107257.3   13941.2
-10.00  0.0000    110552.0   14384.6
 -8.00  0.0402     94893.5   12156.5
 -6.00  0.1486     48581.5   10497.0
 -4.00  0.3252     67303.6    8864.4
 -2.00  0.4055     65540.8    8185.0
  0.00  0.4095     42567.0    7724.5
  2.00  0.4457     35417.3    7488.1
  4.00  0.4497     51731.9    7154.1
  5.00  0.4497     52376.4    6934.6
  6.00  0.4497     40649.3    6477.9
  7.00  0.4497     31218.9    5819.0
  8.00  0.5139     21131.7    5824.2
  9.00  0.5300     35649.8    5833.6
 10.00  0.5300     40841.4    5828.1
 11.00  0.5300     31883.6    6424.9
 12.00  0.5742     24036.4    6844.6
 12.25  0.5742     26323.0    7117.5
 12.50  0.5742     27632.3    7315.0
 12.75  0.5742     30536.7    7519.6
 13.00  0.5340     25894.4    6059.3
 13.25  0.5340     24452.7    6094.3
 14.00  0.5742     22093.3    6139.1
 15.00  0.5742     27495.4    6185.2
 16.00  0.5942     36729.2    6245.6
 17.00  0.5942     46354.6    6328.2
 18.00  0.5942     50272.5    6308.2
 20.00  0.5942     39575.3    6483.6
 13.00  0.5340     26060.5    6133.9
 12.75  0.5340     27784.0    6121.3
 12.50  0.5300     29393.4    6088.4
 12.25  0.5300     30166.8    6013.8
 12.00  0.5742     25048.8    7267.8
 11.75  0.5742     22834.5    7117.6
 11.50  0.5340     26290.1    6952.4
 11.25  0.5340     27315.7    6774.1
 11.00  0.5300     31675.2    6602.4
```

5.18 Re3e Clean -

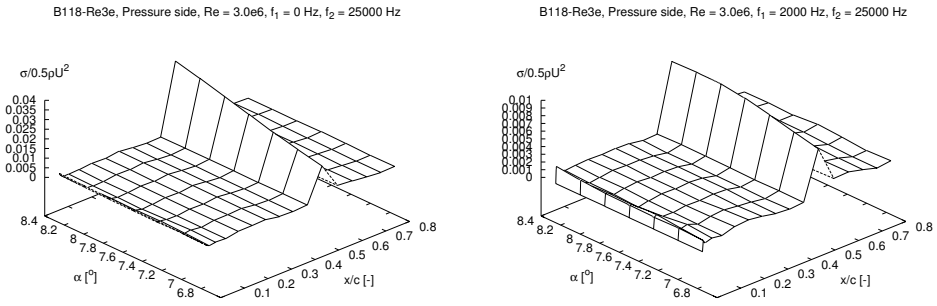

Figure 337: Pressure standard deviations, σ

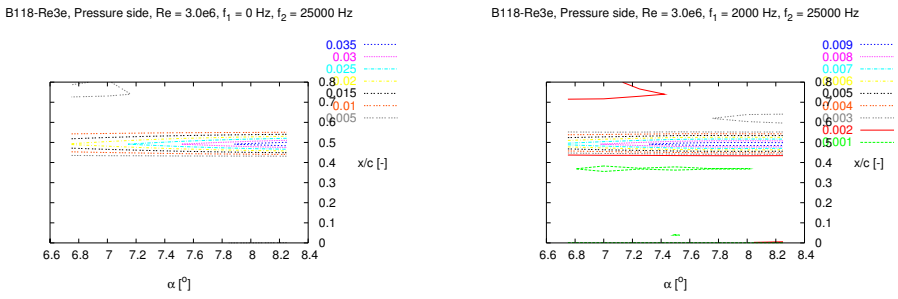

Figure 338: Contours of σ

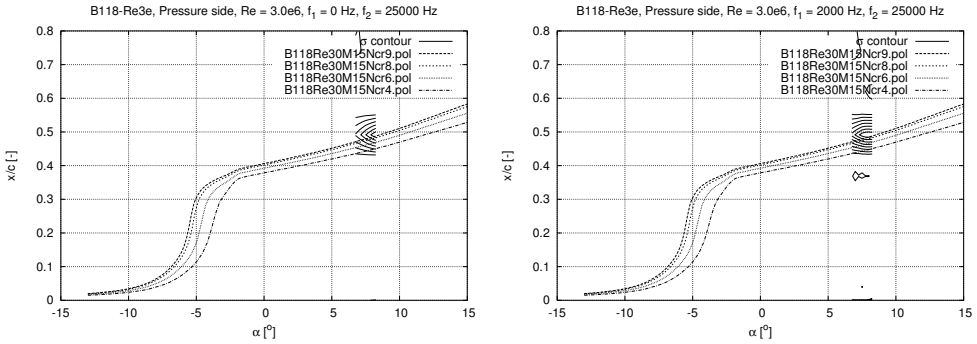

Figure 339: Contours of σ and XFoil data

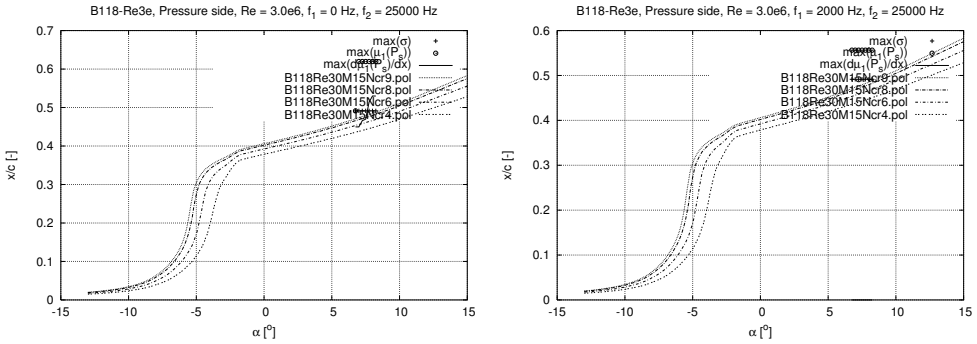

Figure 340: Transition detection

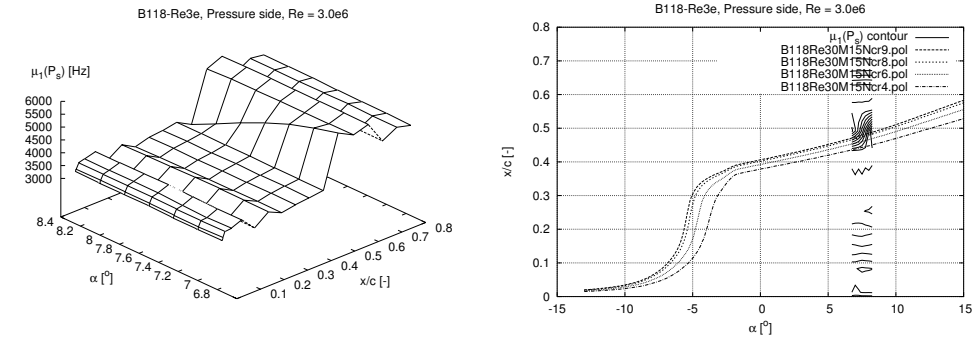

Figure 341: Fourier transform mean, $\mu_1(P_s)$

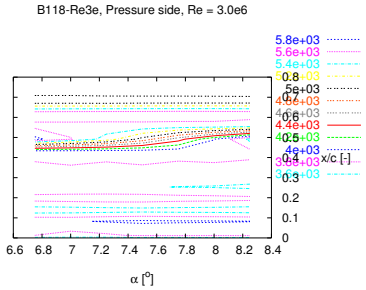

Figure 342: Contours of $\mu_1(P_s)$

```
B118-Re3e
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
  6.75  0.4497     23939.3    5858.9
  7.00  0.4497     20999.0    5727.6
  7.25  0.4658     18043.9    5737.6
  7.50  0.4698     14871.2    5740.8
  7.75  0.5139     14318.8    5747.8
  8.00  0.5300     18668.2    5746.0
  8.25  0.5300     23564.0    5728.4
```

5.19 Re3f Clean 200x200

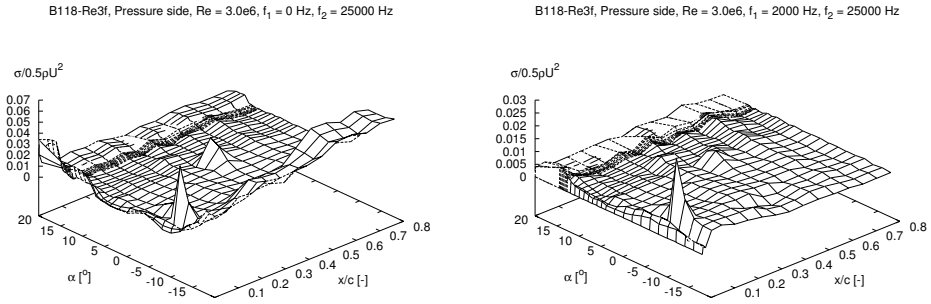

Figure 343: Pressure standard deviations, σ

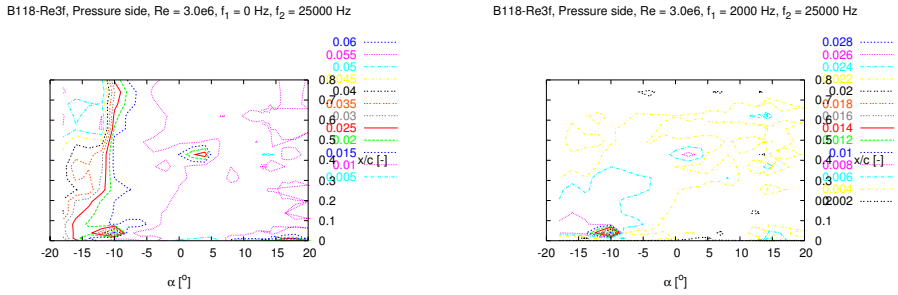

Figure 344: Contours of σ

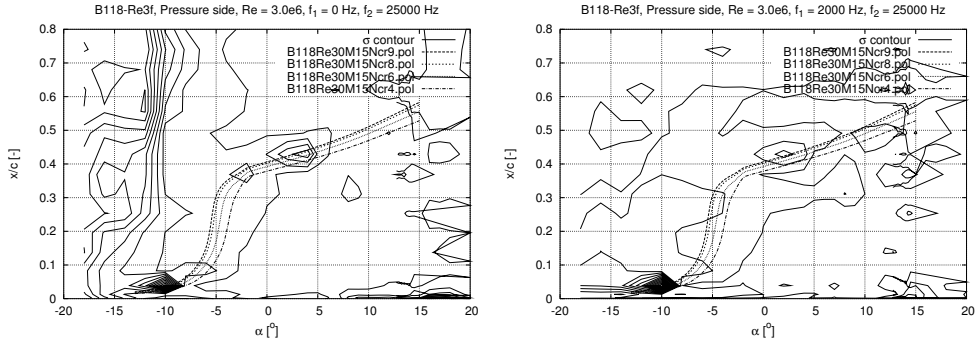

Figure 345: Contours of σ and XFoil data

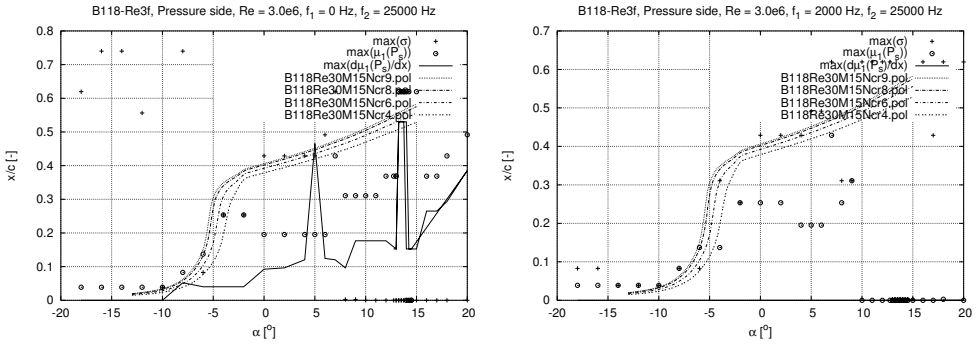

Figure 346: Transition detection

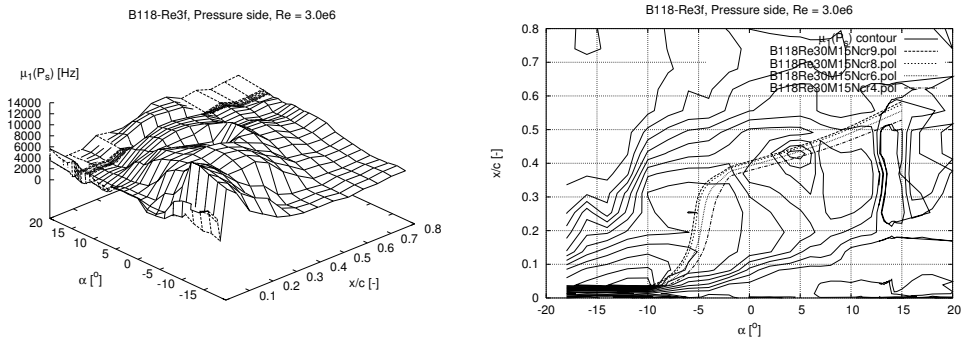

Figure 347: Fourier transform mean, $\mu_1(P_s)$

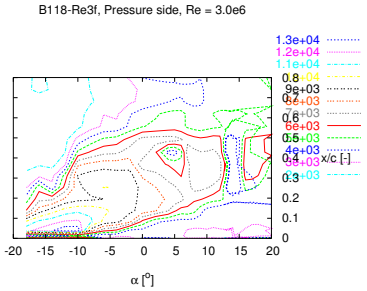

Figure 348: Contours of $\mu_1(P_s)$

```
B118-Re3f
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     97294.7   11751.5
-16.00  0.0000     96149.2   12286.1
-14.00  0.0000    109109.2   12943.2
-12.00  0.0000    112589.4   13741.5
-10.00  0.0000    107705.1   13711.0
 -8.00  0.0522     86798.9   11182.9
 -6.00  0.0402     85662.8   10297.6
 -4.00  0.0402     82343.8    9975.4
 -2.00  0.0402     71324.0    9831.6
  0.00  0.0923     51192.4    8712.8
  2.00  0.0964     51005.2    8245.5
  4.00  0.1205     43244.2    7901.4
  5.00  0.4658     39891.1    7717.4
  6.00  0.1245     33952.4    7329.9
  7.00  0.1205     30370.3    7489.0
  8.00  0.0964     26601.5    7885.6
  9.00  0.1767     26865.5    7823.3
 10.00  0.1767     33619.9    7581.5
 11.00  0.1767     32401.2    7473.2
```

12.00	0.1767	31635.0	7281.7
13.00	0.1526	18690.6	5690.6
13.25	0.5300	17480.1	5276.8
13.50	0.5300	18007.2	5238.0
13.75	0.5300	17344.9	5221.9
14.00	0.5300	16081.6	5286.5
14.25	0.1526	13491.6	5257.9
14.50	0.1526	12906.1	5366.7
15.00	0.1526	13383.2	5283.1
16.00	0.2650	18419.7	6788.3
17.00	0.2650	19411.6	6804.2
18.00	0.2931	17624.7	6736.4
20.00	0.3855	23329.2	6536.1
14.50	0.1526	12944.2	5451.7
14.25	0.1526	13558.2	5392.3
14.00	0.1526	13356.0	5281.8
13.75	0.5300	16949.4	5235.9
13.50	0.5300	17204.1	5245.0
13.25	0.5300	18120.2	5254.6
13.00	0.1526	18132.8	5508.2
12.75	0.1526	20342.1	6284.0

5.20 Re3g ZZ90 x/c=5% suc. x/c=10% press. 200x200

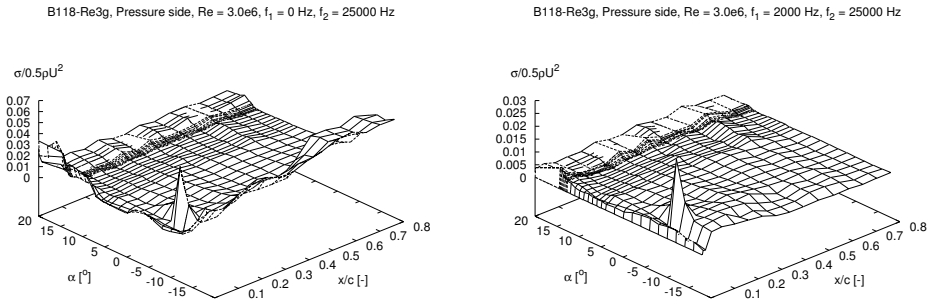

Figure 349: Pressure standard deviations, σ

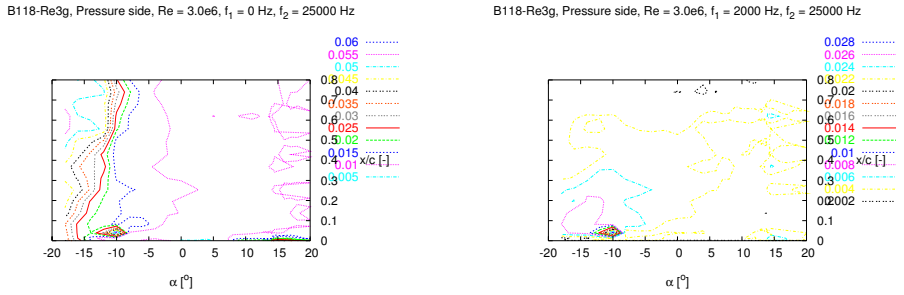

Figure 350: Contours of σ

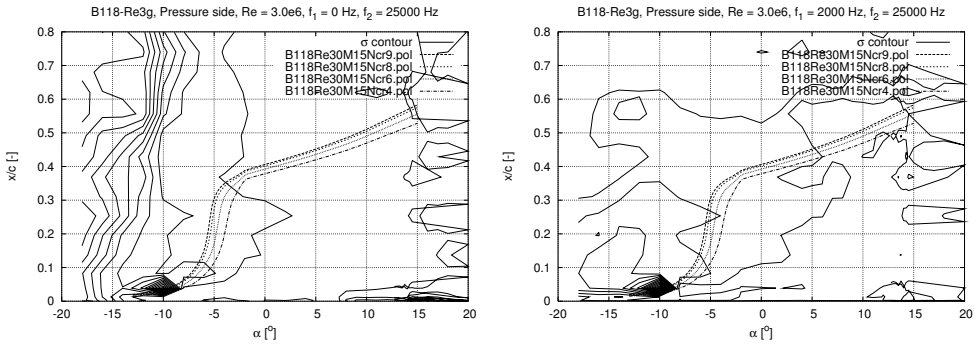

Figure 351: Contours of σ and XFoil data

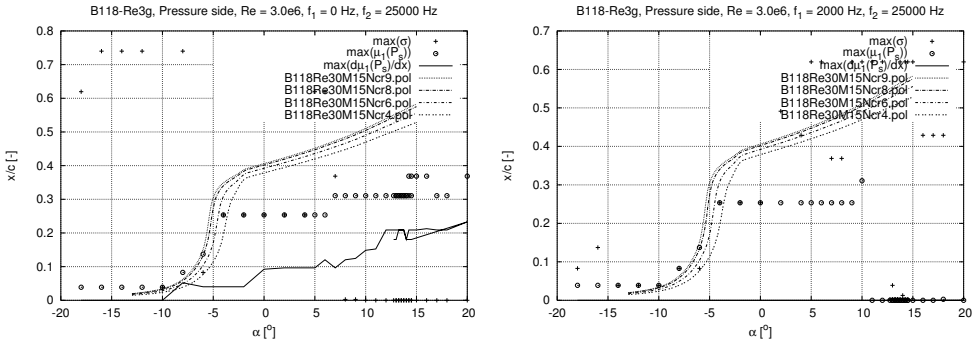

Figure 352: Transition detection

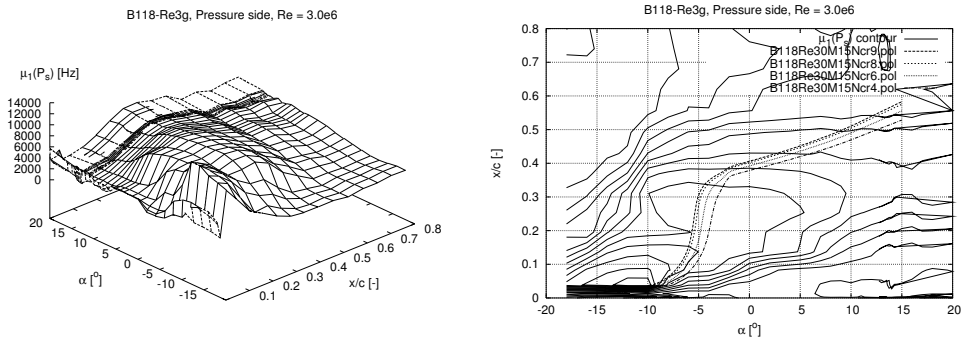

Figure 353: Fourier transform mean, $\mu_1(P_s)$

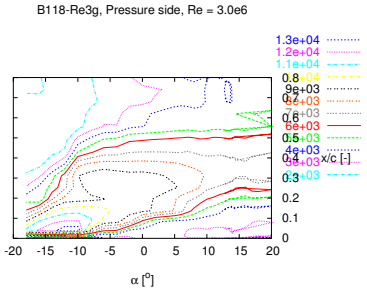

Figure 354: Contours of $\mu_1(P_s)$

```
B118-Re3g
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     89132.7   11502.4
-16.00  0.0000     92660.0   12128.1
-14.00  0.0000     97331.1   12645.8
-12.00  0.0000    109675.7   13771.2
-10.00  0.0000    106155.0   13742.6
 -8.00  0.0522     85057.8   11140.1
 -6.00  0.0402     83201.5   10396.7
 -4.00  0.0402     83150.3    9923.0
 -2.00  0.0402     70560.4    9800.6
  0.00  0.0923     59895.4    9708.0
  2.00  0.0964     60211.7    9490.4
  4.00  0.0964     55429.1    9252.9
  5.00  0.0964     52478.0    9099.4
  6.00  0.1205     46314.4    8832.0
  7.00  0.0964     38825.2    8674.7
  8.00  0.1205     33141.4    8408.3
  9.00  0.1245     27766.4    8171.0
 10.00  0.1486     23155.5    7833.3
 11.00  0.1526     22618.0    7628.4
```

12.00	0.2088	23538.7	7644.6
13.00	0.2088	25562.9	7626.7
13.25	0.2088	25697.3	7603.5
13.50	0.2088	25847.5	7592.9
13.75	0.2088	24910.8	7546.6
14.00	0.1807	24377.6	7458.9
14.25	0.2088	22027.9	7296.4
14.50	0.2088	21556.8	7257.9
15.00	0.2088	21256.6	7197.2
16.00	0.2128	22093.0	7139.1
17.00	0.2088	25305.1	7514.2
18.00	0.2088	26746.7	7614.6
20.00	0.2329	25744.2	7674.8
14.50	0.1807	20983.0	7236.1
14.25	0.1807	21919.0	7329.2
14.00	0.1807	24189.2	7543.4
13.75	0.2088	25440.5	7562.2
13.50	0.2088	25807.9	7590.3
13.25	0.2088	26033.1	7632.7
13.00	0.1807	26067.5	7651.9
12.75	0.1807	25335.5	7646.5

5.21 Re3h LER. ZZ 2% 200x200

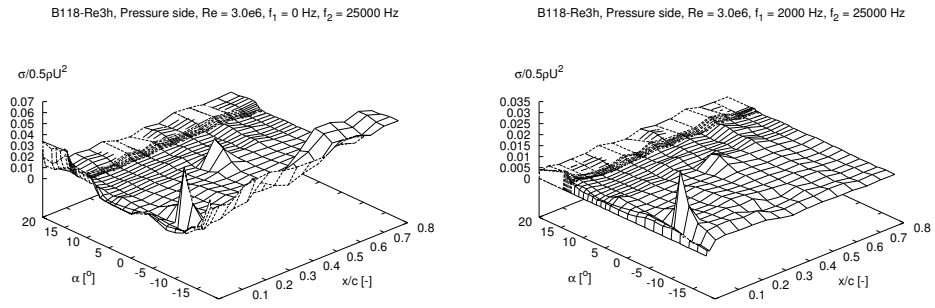

Figure 355: Pressure standard deviations, σ

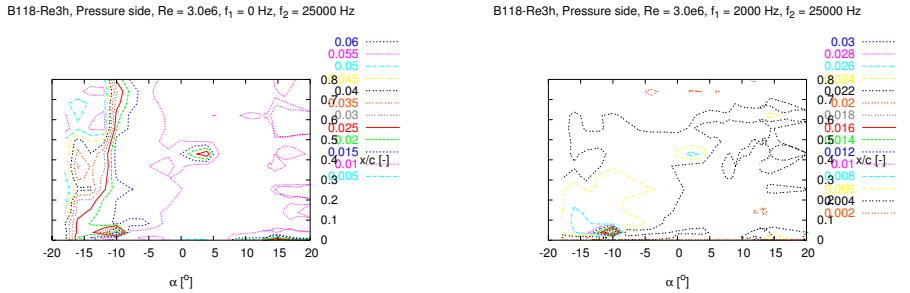

Figure 356: Contours of σ

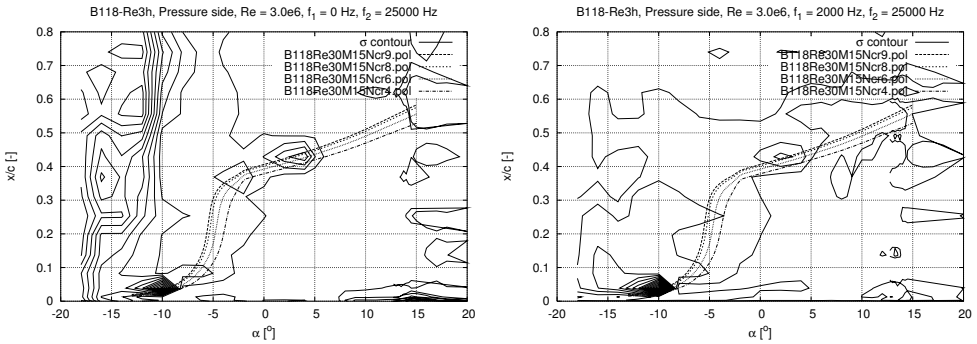

Figure 357: Contours of σ and XFoil data

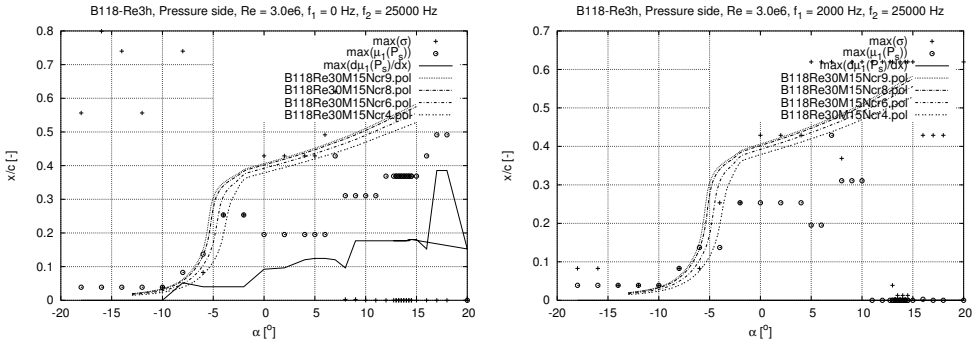

Figure 358: Transition detection

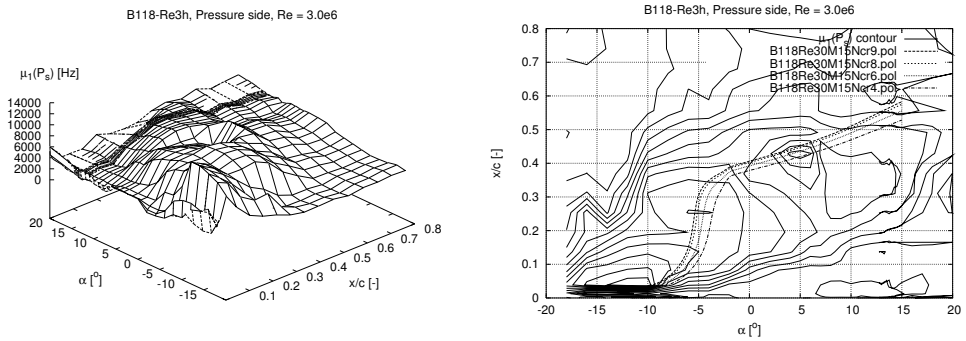

Figure 359: Fourier transform mean, $\mu_1(P_s)$

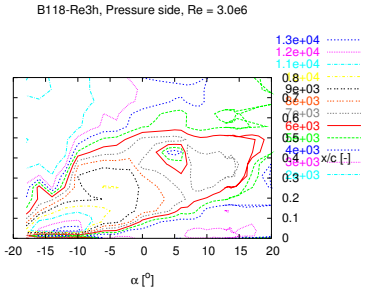

Figure 360: Contours of $\mu_1(P_s)$

```
B118-Re3h
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     45826.6   10465.3
-16.00  0.0000     93761.3   12187.0
-14.00  0.0000    108589.2   12982.1
-12.00  0.0000    112612.8   13745.4
-10.00  0.0000    107941.0   13760.5
 -8.00  0.0522     87223.6   11184.1
 -6.00  0.0402     84577.5   10353.0
 -4.00  0.0402     82738.7   10019.9
 -2.00  0.0402     71223.3    9886.0
  0.00  0.0923     51855.6    8742.4
  2.00  0.0964     50830.2    8333.7
  4.00  0.1205     44425.4    7885.8
  5.00  0.1245     40275.3    7711.4
  6.00  0.1245     35062.4    7407.9
  7.00  0.1205     31735.2    7228.5
  8.00  0.0964     26977.0    7944.2
  9.00  0.1767     25504.1    7987.8
 10.00  0.1767     33814.1    7702.6
 11.00  0.1767     32077.0    7523.4
```

```
12.00  0.1767     31513.6     7416.3
13.00  0.1767     29408.8     7288.1
13.25  0.1767     28439.0     7252.7
13.50  0.1767     27909.8     7229.4
13.75  0.1767     25062.2     7294.3
14.00  0.1767     23882.3     7224.2
14.25  0.1807     23449.8     7164.3
14.50  0.1807     22086.7     7151.9
15.00  0.1807     18082.9     6959.2
16.00  0.1526     16527.3     6708.7
17.00  0.3855     16279.0     6529.0
18.00  0.3855     22051.0     6308.7
20.00  0.1526     18639.3     5975.8
14.50  0.1807     22469.7     6971.4
14.25  0.1767     23609.9     7054.7
14.00  0.1767     24101.9     7100.1
13.75  0.1767     27330.4     7106.2
13.50  0.1767     27469.7     7163.1
13.25  0.1767     28823.2     7186.1
13.00  0.1767     29190.3     7206.6
12.75  0.1767     29736.9     7268.6
```

5.22 Re3i Trip wire. Bump tape 0,1 2% 200x200

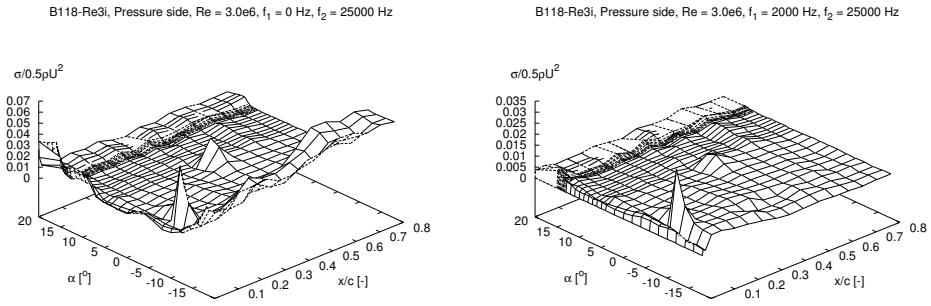

Figure 361: Pressure standard deviations, σ

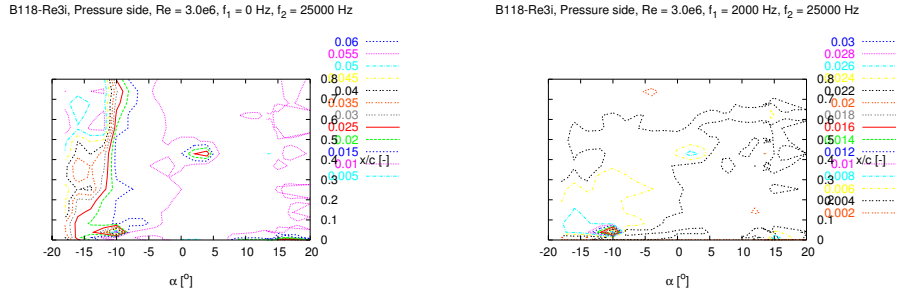

Figure 362: Contours of σ

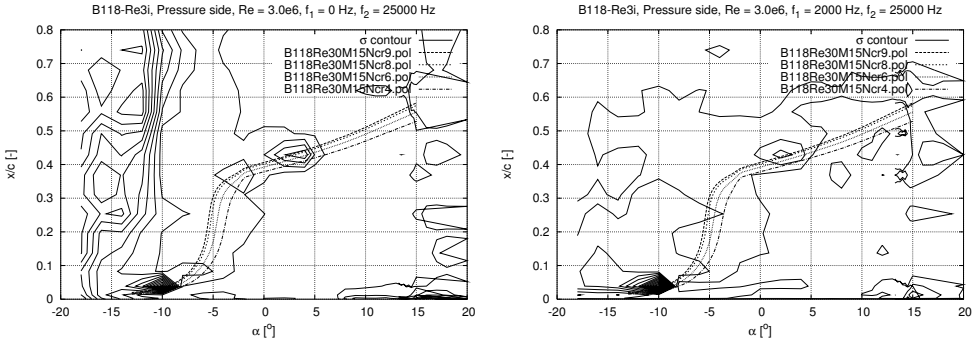

Figure 363: Contours of σ and XFoil data

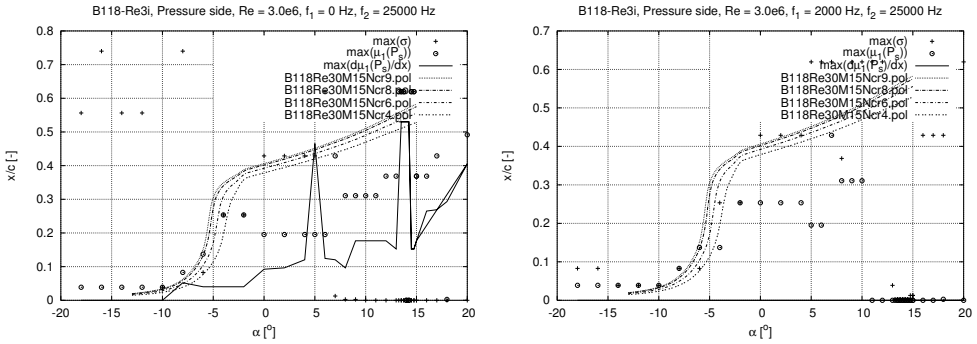

Figure 364: Transition detection

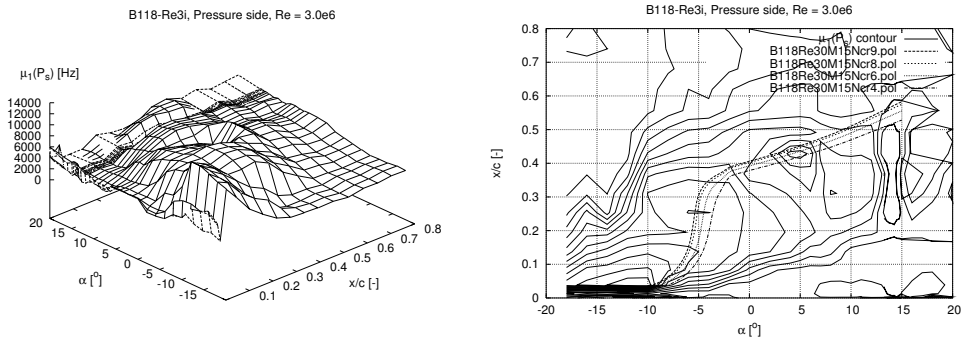

Figure 365: Fourier transform mean, $\mu_1(P_s)$

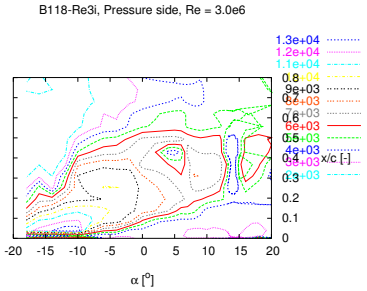

Figure 366: Contours of $\mu_1(P_s)$

```
B118-Re3i
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     97395.6   11684.7
-16.00  0.0000     95735.1   12276.5
-14.00  0.0000    108857.8   12998.5
-12.00  0.0000    112975.8   13776.0
-10.00  0.0000    107997.4   13770.4
 -8.00  0.0522     87060.0   11169.1
 -6.00  0.0402     85190.9   10348.8
 -4.00  0.0402     83158.2   10005.3
 -2.00  0.0402     70584.0    9884.0
  0.00  0.0923     50994.0    8711.2
  2.00  0.0964     50470.7    8324.3
  4.00  0.1205     44004.9    7892.9
  5.00  0.4658     39476.6    7729.4
  6.00  0.1245     34475.1    7345.2
  7.00  0.1205     31193.6    7300.8
  8.00  0.0964     26144.8    8041.4
  9.00  0.1767     27094.9    7966.4
 10.00  0.1767     33559.0    7672.5
 11.00  0.1767     32978.9    7522.3
```

```
12.00  0.1767     32309.6     7379.7
13.00  0.1526     19665.6     6086.3
13.50  0.5300     17625.1     5282.3
13.75  0.5300     17087.9     5277.4
14.00  0.5300     16458.3     5310.3
14.25  0.5300     15384.2     5363.5
14.50  0.1526     13150.7     5309.5
14.75  0.1526     13731.9     5342.0
15.00  0.1767     15200.6     5648.3
16.00  0.2650     19621.8     6926.7
17.00  0.2690     17538.9     6614.9
18.00  0.2931     16385.0     7071.8
20.00  0.4055     21839.8     6157.0
15.00  0.1767     16080.3     5641.5
14.75  0.1526     14026.0     5363.3
14.50  0.1526     13207.1     5316.0
14.25  0.5300     15923.7     5323.2
14.00  0.5300     16059.1     5306.4
13.75  0.5300     17182.2     5274.8
13.50  0.5300     16878.2     5278.3
13.25  0.5300     18467.0     5303.1
```

5.23 Re3j Clean 100x100

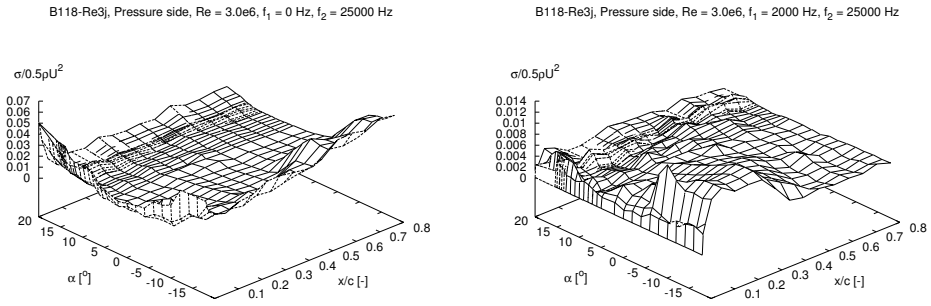

Figure 367: Pressure standard deviations, σ

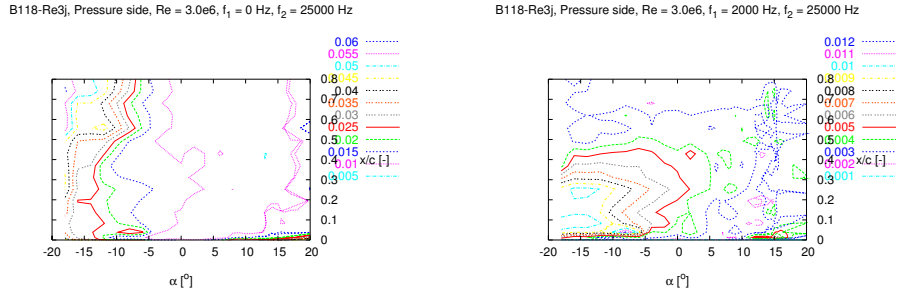

Figure 368: Contours of σ

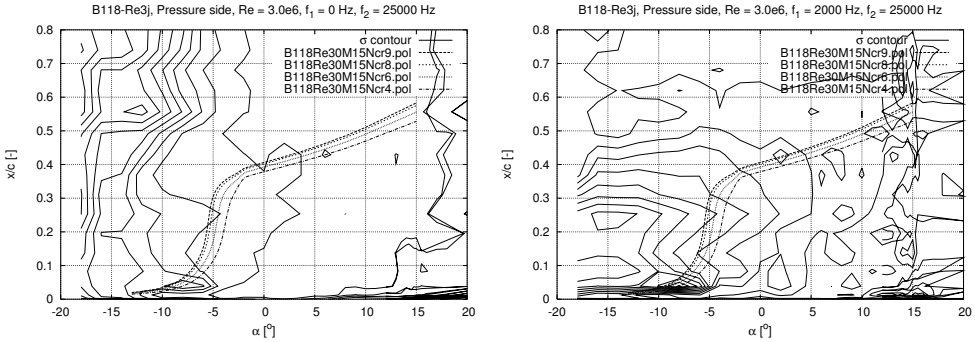

Figure 369: Contours of σ and XFoil data

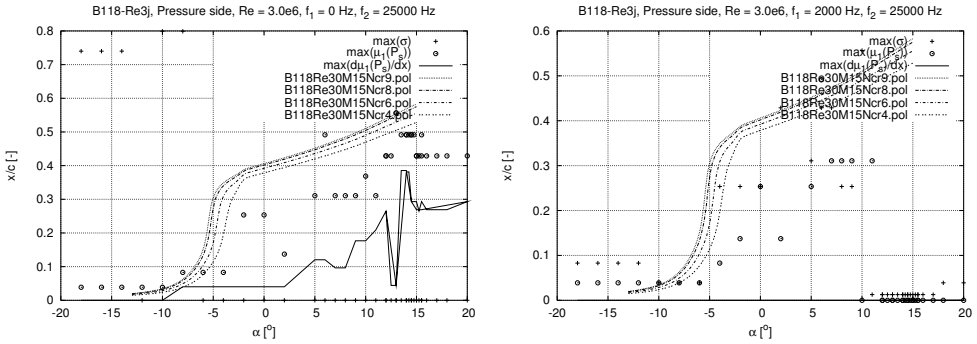

Figure 370: Transition detection

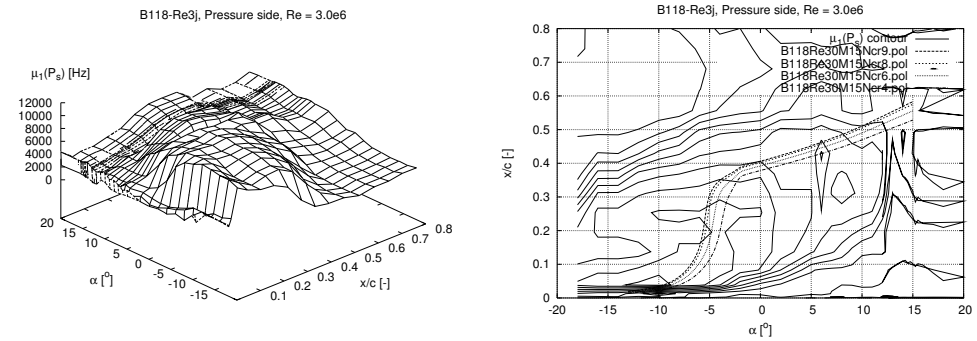

Figure 371: Fourier transform mean, $\mu_1(P_s)$

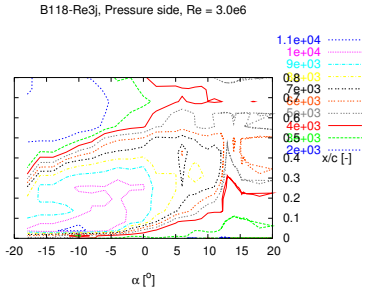

Figure 372: Contours of $\mu_1(P_s)$

```
B118-Re3j
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     59424.5   10235.9
-16.00  0.0000     71600.2   10893.5
-14.00  0.0000     71367.4   10892.7
-12.00  0.0000     82744.7   11181.3
-10.00  0.0000    103332.8   11368.6
 -8.00  0.0402     99583.4   10970.8
 -6.00  0.0402     92372.4   10790.0
 -4.00  0.0402     98844.4   10619.3
 -2.00  0.0402     84714.6   10095.1
  0.00  0.0402     79648.1   10104.1
  2.00  0.0402     55772.1    8658.6
  5.00  0.1205     40659.1    8071.9
  6.00  0.1205     35994.0    7655.5
  7.00  0.0964     32915.3    8047.5
  8.00  0.0964     27544.6    8414.7
  9.00  0.1767     23622.8    8061.7
 10.00  0.1767     27416.3    7905.8
 11.00  0.2088     26013.4    7846.1
 12.00  0.2650     20649.4    7001.6
```

13.00	0.0442	12274.5	5345.5
14.00	0.3814	14638.1	6159.0
14.25	0.3814	12305.1	6011.5
14.50	0.2931	11326.9	5847.2
14.75	0.2931	12891.5	5961.6
15.00	0.2931	12996.8	5897.6
15.25	0.2650	15902.2	6198.4
15.50	0.2931	14933.3	6064.9
16.00	0.2690	15664.2	6153.8
17.00	0.2690	18566.7	6306.4
18.00	0.2690	19497.6	6524.2
20.00	0.2931	19954.5	6403.0
15.50	0.2690	15641.4	6143.6
15.00	0.2690	13274.4	6026.0
14.50	0.2931	11182.8	5894.4
14.00	0.3855	14177.2	6076.1
13.50	0.3855	11426.5	5564.7
13.00	0.0442	12006.0	5349.2
12.50	0.0442	15099.4	5842.2
12.00	0.2650	21639.0	7033.0

5.24 Re3k ZZ90 x/c=5% suc. x/c=10% press.

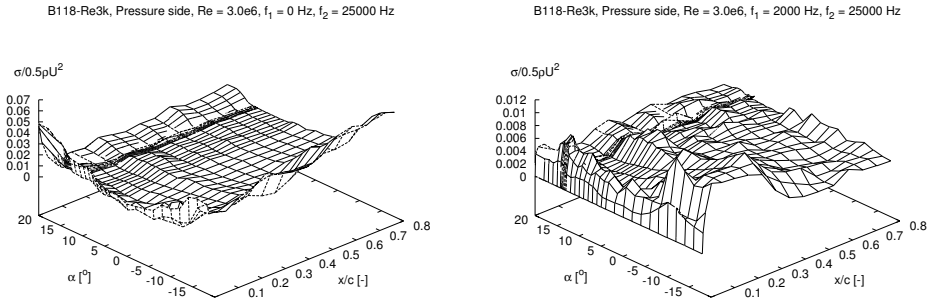

Figure 373: Pressure standard deviations, σ

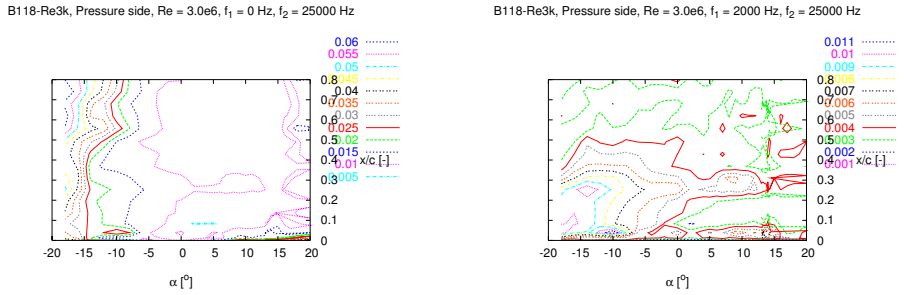

Figure 374: Contours of σ

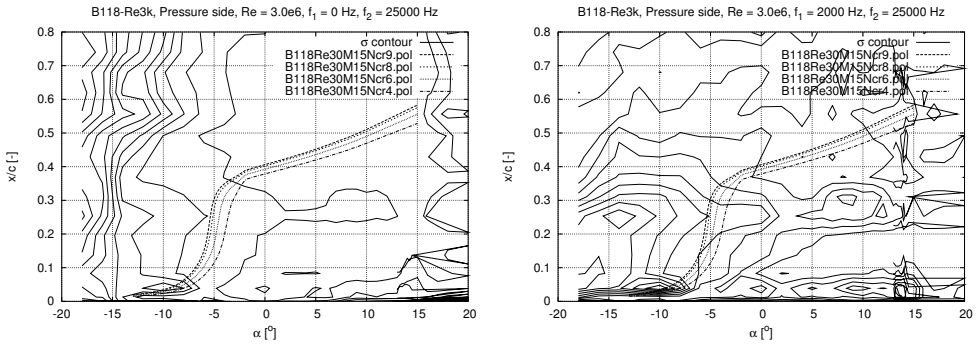

Figure 375: Contours of σ and XFoil data

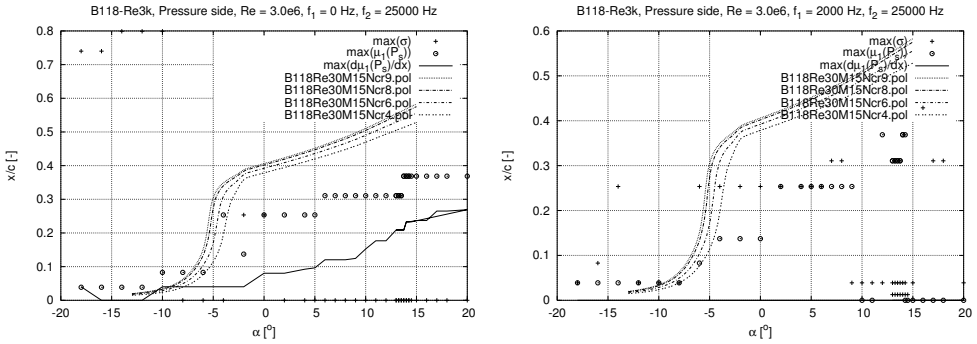

Figure 376: Transition detection

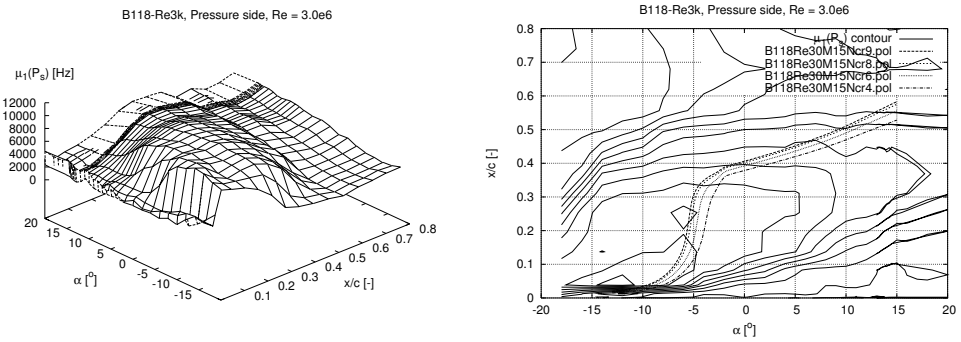

Figure 377: Fourier transform mean, $\mu_1(P_s)$

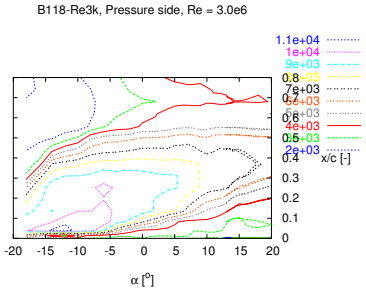

Figure 378: Contours of $\mu_1(P_s)$

```
B118-Re3k
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0402     52384.5    9886.0
-16.00  0.0000     69379.9   10416.1
-14.00  0.0000     88184.0   11166.3
-12.00  0.0000    103344.5   11396.6
-10.00  0.0402     99079.3   10946.9
 -8.00  0.0402     93151.1   10750.1
 -6.00  0.0402     97901.9   10525.3
 -4.00  0.0402     83967.0    9883.0
 -2.00  0.0402     77132.4    9856.3
  0.00  0.0803     60882.5    9631.1
  2.00  0.0803     52749.3    9438.2
  4.00  0.0923     51814.5    9118.2
  5.00  0.0964     50052.7    9084.7
  6.00  0.1205     45787.3    8883.4
  7.00  0.1205     41298.5    8626.5
  8.00  0.1205     34762.6    8300.7
  9.00  0.1245     28134.2    7996.0
 10.00  0.1526     23831.7    7852.0
 11.00  0.1767     25114.5    7823.1
```

12.00	0.1767	25608.2	7893.6
13.00	0.2088	26658.9	7837.3
13.25	0.2088	27107.4	7762.9
13.50	0.2088	27187.9	7697.6
13.75	0.2088	26652.4	7638.6
14.00	0.2329	26501.5	7636.8
14.25	0.2329	26539.0	7652.0
15.00	0.2369	24969.8	7481.3
16.00	0.2369	23209.2	7365.2
17.00	0.2650	21713.2	7166.8
18.00	0.2650	20802.2	6940.9
20.00	0.2690	19791.8	6745.4
14.50	0.2329	26409.9	7588.1
14.25	0.2329	27322.9	7664.8
14.00	0.2329	26442.3	7670.2
13.75	0.2088	27984.3	7708.6
13.50	0.2088	28346.7	7776.6
13.25	0.2088	27992.1	7827.9
13.00	0.2088	27871.7	7853.7

5.25 Re3m Trip wire. Bump tape 0,1 2% 100x100

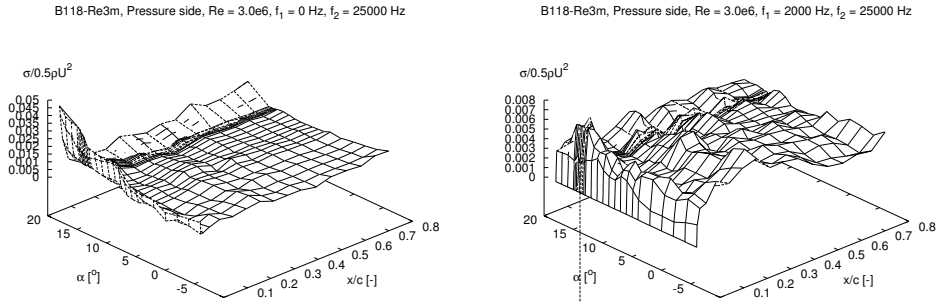

Figure 379: Pressure standard deviations, σ

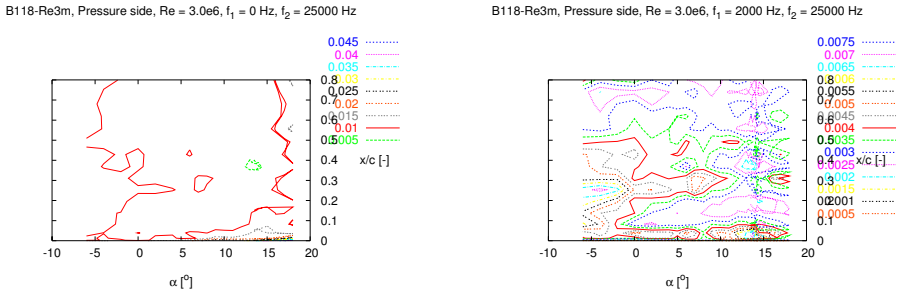

Figure 380: Contours of σ

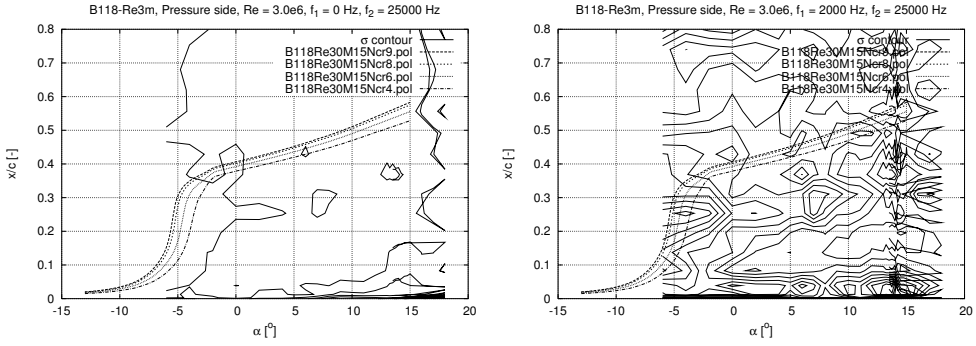

Figure 381: Contours of σ and XFoil data

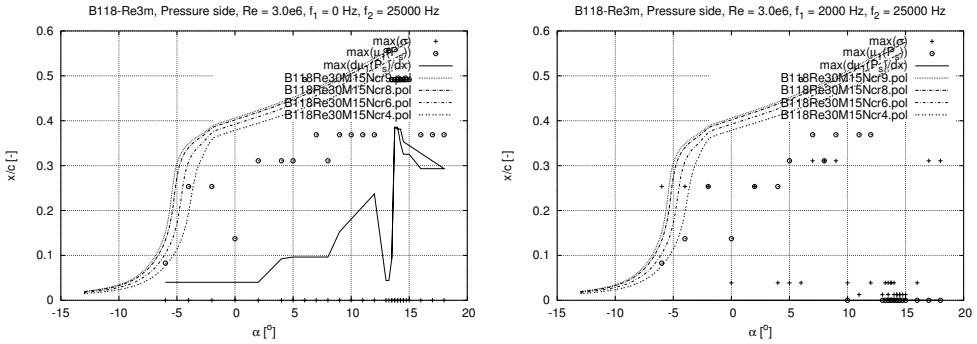

Figure 382: Transition detection

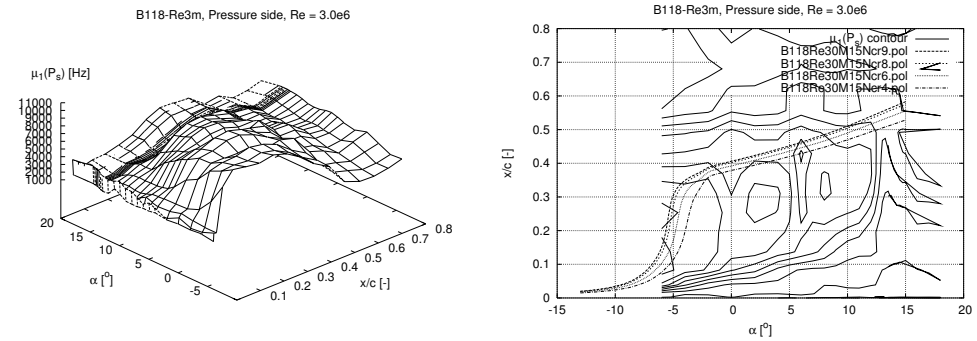

Figure 383: Fourier transform mean, $\mu_1(P_s)$

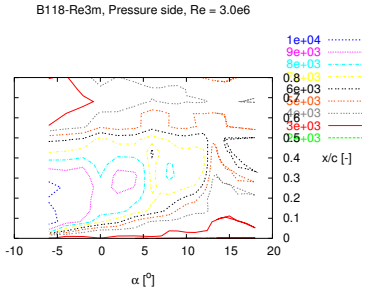

Figure 384: Contours of $\mu_1(P_s)$

```
B118-Re3m
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
 -6.00  0.0402     98492.8   10473.6
 -4.00  0.0402     84979.3    9874.6
 -2.00  0.0402     78267.9    9880.0
  0.00  0.0402     56990.9    8527.5
  2.00  0.0402     49651.6    9334.3
  4.00  0.0923     41900.9    9171.3
  5.00  0.0964     40947.8    8302.5
  6.00  0.0964     35777.6    7584.2
  7.00  0.0964     33243.3    7770.5
  8.00  0.0964     28623.1    8178.1
  9.00  0.1526     21553.6    7883.0
 10.00  0.1807     25178.5    7836.2
 11.00  0.2088     24619.6    7826.9
 12.00  0.2369     20413.6    7208.3
 13.00  0.0442     12593.7    5330.5
 13.25  0.0442     10941.1    5256.0
 13.50  0.0923      9701.2    5290.9
 13.75  0.3855      9857.9    5563.6
 14.00  0.3855     11868.1    5836.7
```

```
14.25  0.3493     11065.3     5928.2
14.50  0.3252     13224.9     6130.4
14.75  0.3252     14375.5     6197.3
15.00  0.3252     13859.9     6164.4
16.00  0.2931     16043.1     6198.9
17.00  0.2931     17888.1     6318.2
18.00  0.2931     19572.4     6516.8
14.50  0.3533     13005.2     6006.0
14.25  0.3814     12007.4     5947.0
14.00  0.3814     11903.7     5904.6
13.75  0.3855     10657.6     5581.4
13.50  0.0923      9562.6     5284.8
```

5.26 Re4a Clean -

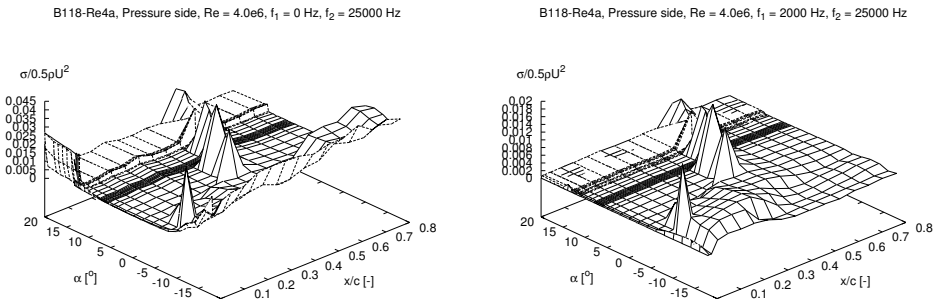

Figure 385: Pressure standard deviations, σ

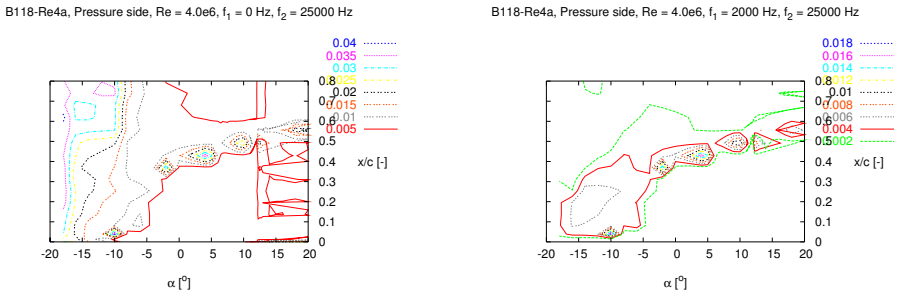

Figure 386: Contours of σ

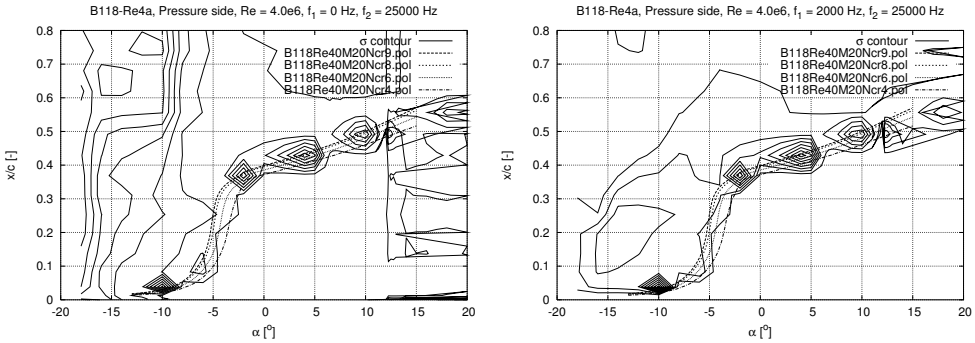

Figure 387: Contours of σ and XFoil data

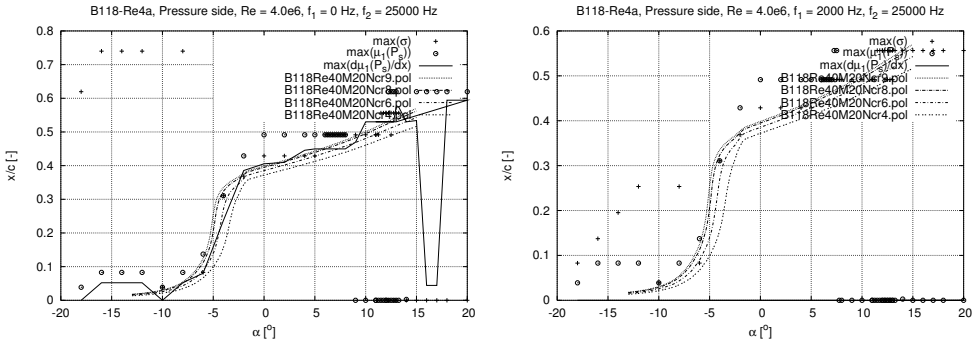

Figure 388: Transition detection

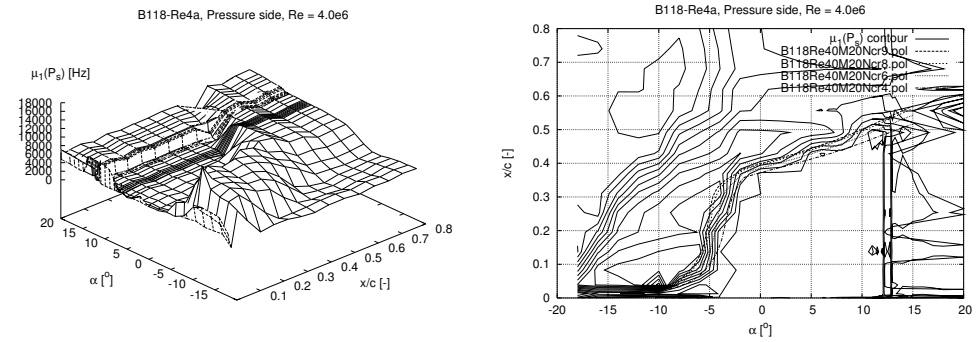

Figure 389: Fourier transform mean, $\mu_1(P_s)$

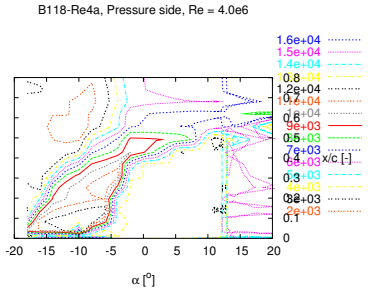

Figure 390: Contours of $\mu_1(P_s)$

```
B118-Re4a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     85941.1   10096.2
-16.00  0.0522     78830.6   11769.0
-14.00  0.0522     93527.3   12474.9
-12.00  0.0522     97748.0   12582.3
-10.00  0.0000    132762.9   16518.2
 -8.00  0.0522     99509.7   12716.1
 -6.00  0.0803     91994.1   12577.3
 -4.00  0.2369     65056.7   11533.9
 -2.00  0.3855     55687.3   10017.0
  0.00  0.4055     64795.5    9217.5
  2.00  0.4095     54020.5    9106.2
  4.00  0.4457     46906.7    8858.9
  5.00  0.4497     60640.6    8749.7
  6.00  0.4497     63170.0    8535.1
  6.25  0.4497     62771.1    8461.4
  6.50  0.4497     59328.1    8363.8
  6.75  0.4497     58952.0    8247.6
  7.00  0.4497     55284.6    8115.7
  7.25  0.4497     55283.0    8005.2
```

7.50	0.4497	51498.6	7825.3
7.75	0.4497	51013.6	7608.4
8.00	0.4497	45882.7	7306.3
9.00	0.4698	32083.2	7631.6
10.00	0.5300	38041.2	7945.8
11.00	0.5300	50591.4	8126.4
12.00	0.5300	44499.9	8250.8
12.25	0.5300	43773.8	8250.6
12.50	0.5300	40329.0	8259.9
12.75	0.5300	39939.9	8198.2
13.00	0.5742	18145.5	8446.3
13.25	0.5742	19204.8	8438.6
14.00	0.5300	35195.1	8216.3
15.00	0.5340	25066.6	7951.6
16.00	0.0442	24634.8	8027.4
17.00	0.0442	23500.4	8101.7
18.00	0.5942	35215.0	8158.3
20.00	0.5942	53951.8	8145.1
13.00	0.5300	43353.6	7775.4
12.75	0.5300	43944.5	7753.2
12.50	0.5300	43702.1	7734.5
12.25	0.5300	42700.4	7613.8
12.00	0.5300	45899.5	8268.2
11.75	0.5300	46539.5	8222.1
11.50	0.5300	49285.4	8208.9
11.25	0.5300	49876.9	8173.9
11.00	0.5300	50848.1	8139.5

5.27 Re5a Clean -

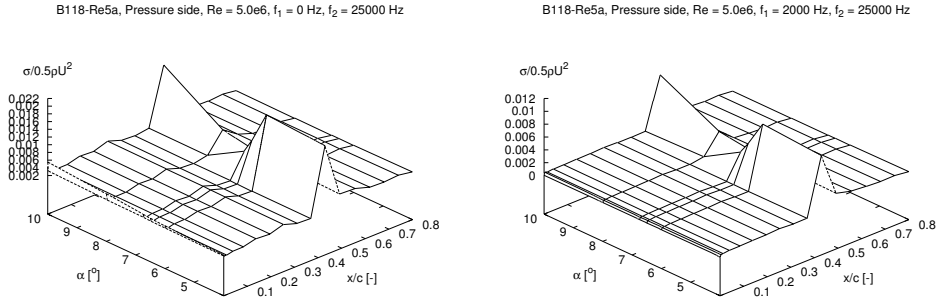

Figure 391: Pressure standard deviations, σ

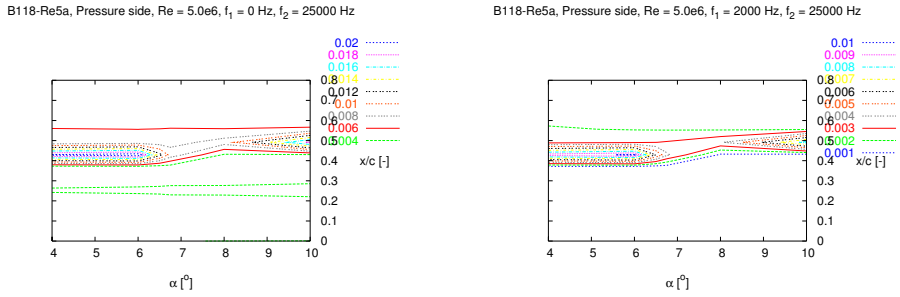

Figure 392: Contours of σ

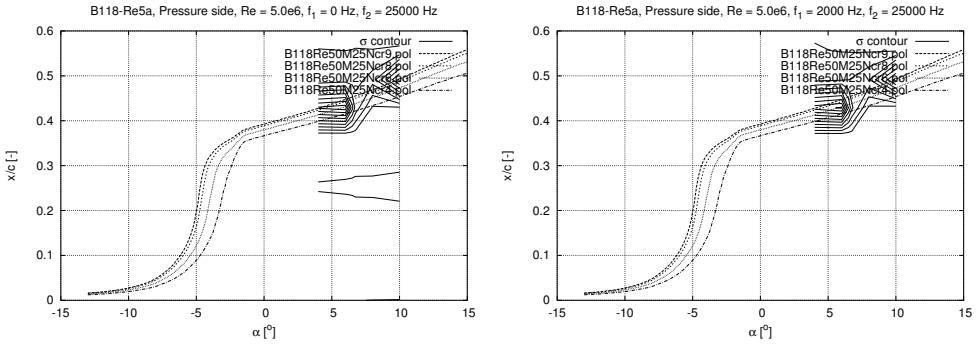

Figure 393: Contours of σ and XFoil data

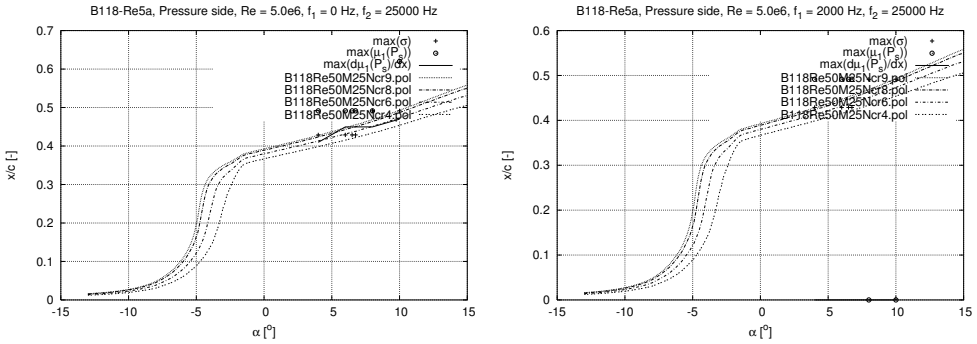

Figure 394: Transition detection

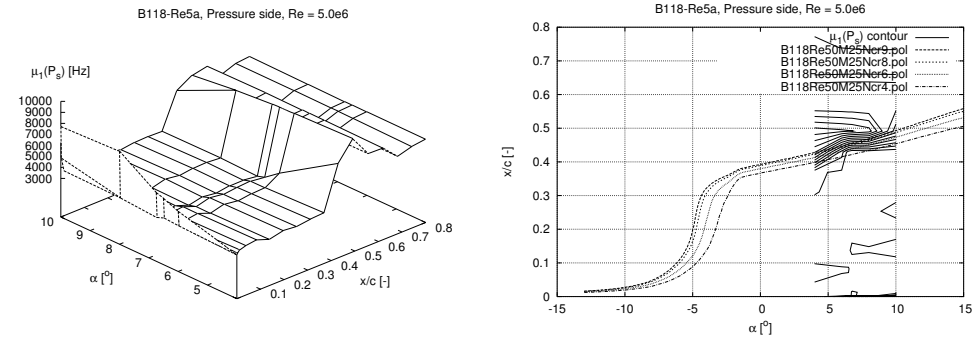

Figure 395: Fourier transform mean, $\mu_1(P_s)$

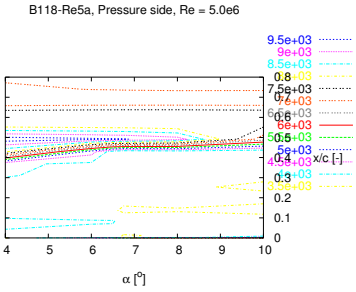

Figure 396: Contours of $\mu_1(P_s)$

```
B118-Re5a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-18.00  0.0000     58694.4    8687.2
-16.00  0.0522     90300.8   11821.8
-14.00  0.0522     88071.8   11783.3
-12.00  0.0522     91323.0   11834.7
-10.00  0.0522     90383.8   12087.7
 -8.00  0.0522     87448.5   12159.0
 -6.00  0.0562    100106.7   12665.0
 -4.00  0.2128     85165.4   11979.6
 -2.00  0.3493     66714.4   10581.4
  0.00  0.3855     74339.9   10322.4
  2.00  0.4055     68067.7    9914.6
  4.00  0.4095     54823.4    9779.0
  5.00  0.4457     50193.2    9740.3
  6.00  0.4497     60486.5    9615.8
  6.25  0.4497     65472.9    9588.9
  6.50  0.4497     67852.9    9551.8
  6.75  0.4497     69944.4    9526.3
  7.00  0.4497     68607.2    9473.5
  7.25  0.4497     69581.4    9434.7
  7.50  0.4497     67315.3    9372.4
  7.75  0.4497     68400.1    9316.9
  8.00  0.4497     65417.3    9232.4
  9.00  0.4497     59085.2    8488.9
 10.00  0.4698     40366.5    7833.1
 11.00  0.5139     36964.5    7961.3
 12.00  0.5300     51757.9    8101.1
 12.25  0.5300     53354.0    8148.5
 12.50  0.5300     52342.4    8088.5
 12.75  0.5300     52692.8    8126.2
 13.00  0.5300     24827.9    8424.3
 13.25  0.5300     21265.9    8410.8
 14.00  0.5300     39889.5    8365.3
 15.00  0.5300     44122.9    8498.7
 16.00  0.5300     37092.3    8593.7
 17.00  0.5300     29004.5    8605.6
 18.00  0.5300     22858.4    8673.7
 20.00  0.5782     31992.6    8734.9
 13.00  0.5300     28910.2    8241.4
 12.75  0.5300     26822.1    8212.9
 12.50  0.5300     24621.0    8194.2
 12.25  0.5300     38315.3    8488.6
 12.00  0.5300     52147.6    8114.9
 11.75  0.5300     48695.0    8111.3
 11.50  0.5139     44856.5    8093.8
 11.25  0.5139     40286.4    8065.2
 11.00  0.5139     37424.8    7989.9
```

5.28 Re6a Clean -

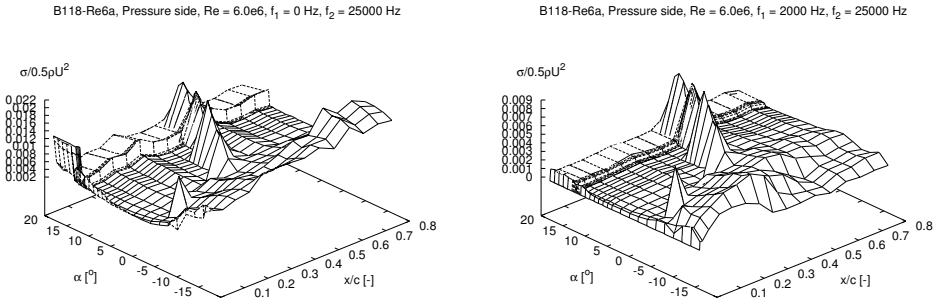

Figure 397: Pressure standard deviations, σ

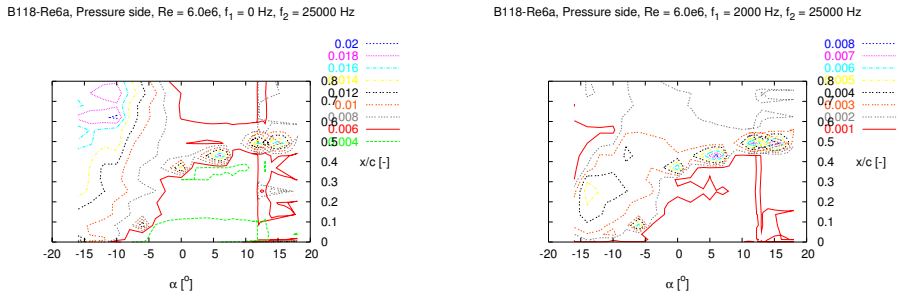

Figure 398: Contours of σ

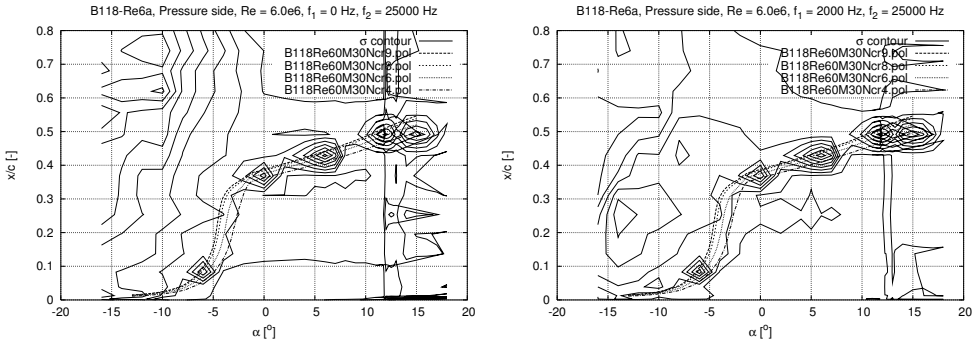

Figure 399: Contours of σ and XFoil data

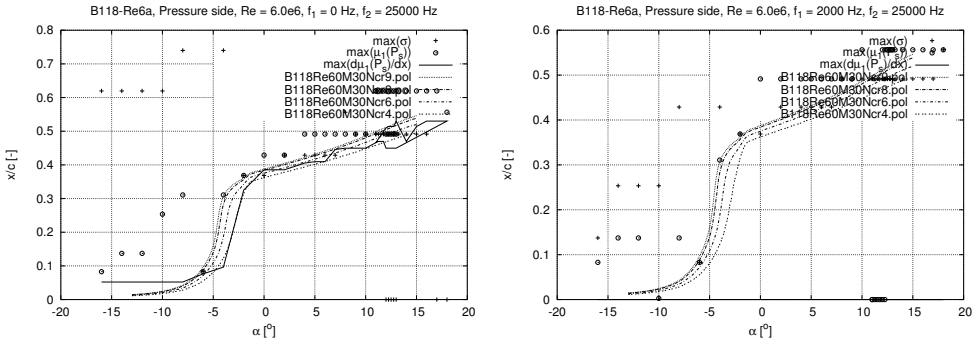

Figure 400: Transition detection

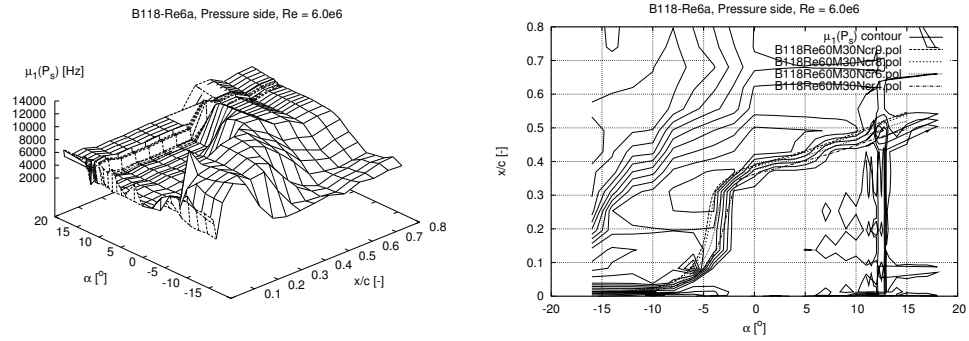

Figure 401: Fourier transform mean, $\mu_1(P_s)$

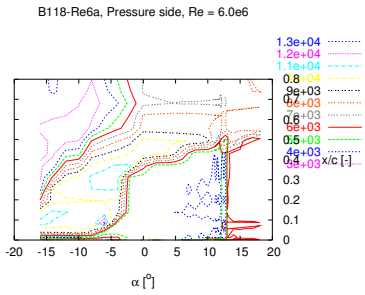

Figure 402: Contours of $\mu_1(P_s)$

```
B118-Re6a
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0522     85285.0   11345.1
-14.00  0.0522     81172.0   11196.6
-12.00  0.0522     77929.8   11036.8
-10.00  0.0522     72615.4   10858.7
 -8.00  0.0522     65963.0   11183.1
 -6.00  0.0763     80847.2   13441.4
 -4.00  0.0964     61471.6   11453.9
 -2.00  0.3252     78379.4   11156.7
  0.00  0.3855     57228.0   10506.7
  2.00  0.3855     70813.5   10404.8
  4.00  0.4055     64481.8   10109.4
  5.00  0.4095     58923.2   10062.9
  6.00  0.4095     47921.1   10031.3
  7.00  0.4457     56504.0    9985.1
  8.00  0.4497     66628.7    9990.9
  9.00  0.4497     67712.7    9850.4
 10.00  0.4497     59012.3    9256.2
 11.00  0.4658     44031.8    8030.6
 12.00  0.5099     31567.1    8003.3
 12.25  0.5139     35160.5    7989.0
 12.50  0.5139     38237.8    7957.6
 12.75  0.5139     43287.4    7945.8
 13.00  0.5300     41814.4    8485.6
 13.25  0.5139     21058.8    8469.8
 14.00  0.4698     23859.3    8576.9
 15.00  0.5139     25998.3    8646.3
 16.00  0.5300     35885.6    8699.8
 17.00  0.5300     44579.0    8790.1
 18.00  0.5300     41462.7    8827.0
 13.00  0.4497     35645.9    8716.4
 12.75  0.4497     38437.2    8950.7
 12.50  0.4497     40548.0    9131.1
 12.25  0.4497     42173.5    9268.4
 12.00  0.4497     59449.6    9256.1
 11.75  0.4698     30328.9    8006.1
 11.50  0.4698     35310.3    8011.2
 11.25  0.4698     37657.6    8025.0
 11.00  0.4658     43187.4    8040.4
```

5.29 Re6b ZZ90 x/c=5% suc. x/c=10% press. -

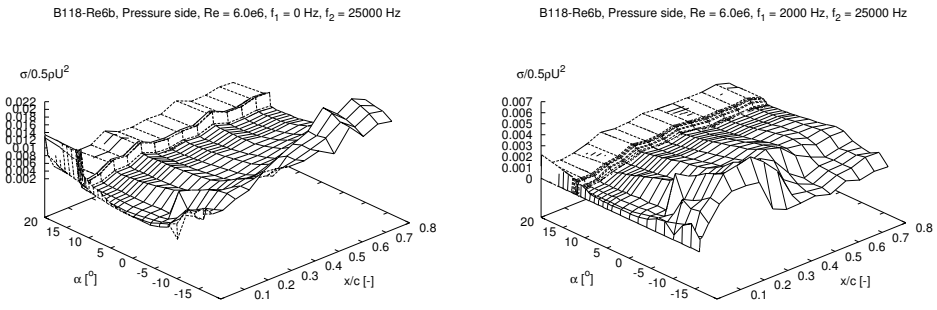

Figure 403: Pressure standard deviations, σ

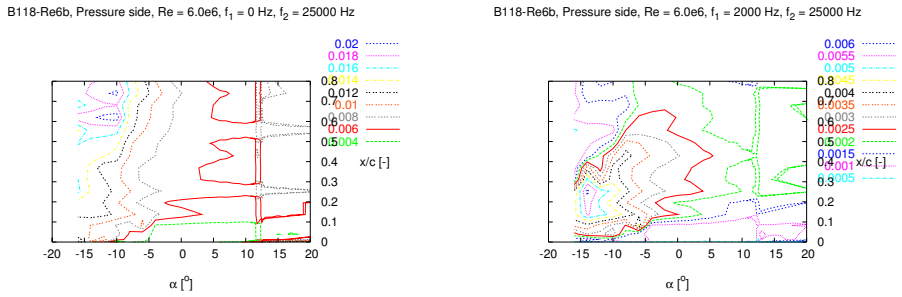

Figure 404: Contours of σ

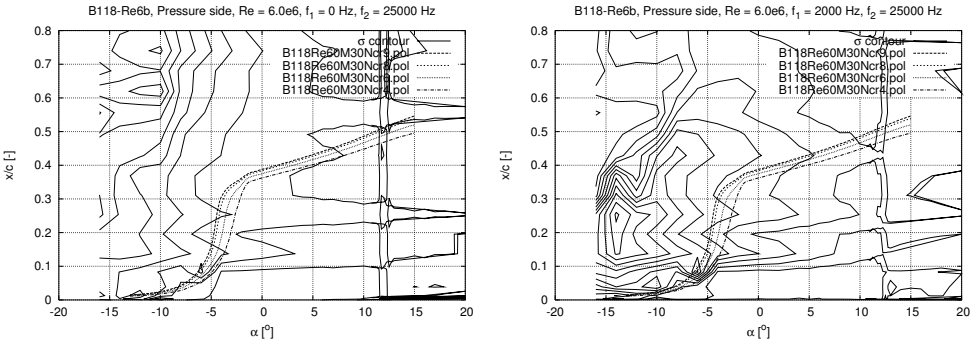

Figure 405: Contours of σ and XFoil data

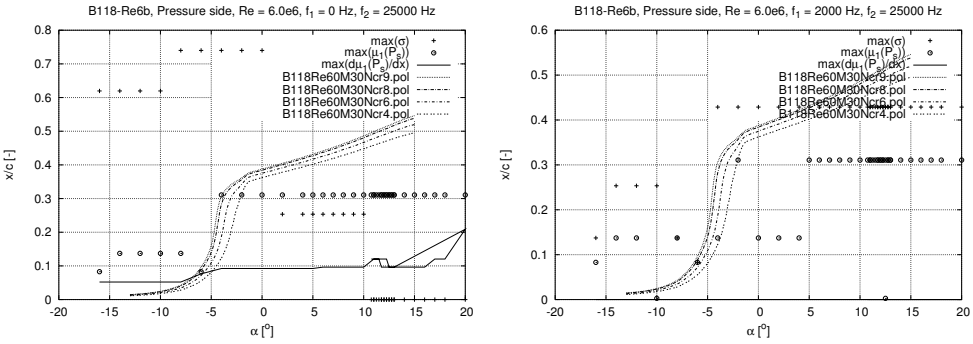

Figure 406: Transition detection

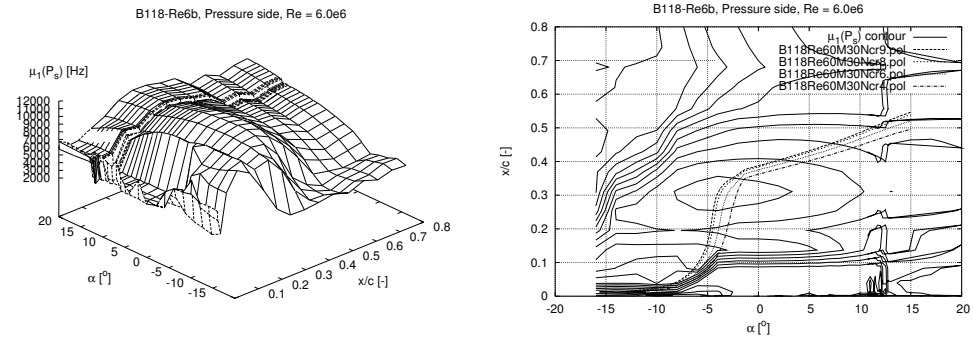

Figure 407: Fourier transform mean, $\mu_1(P_s)$

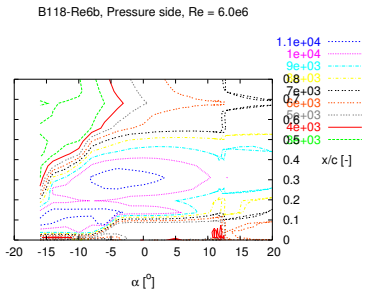

Figure 408: Contours of $\mu_1(P_s)$

```
B118-Re6b
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0522     82935.5   11472.3
-14.00  0.0522     87898.3   11558.7
-12.00  0.0522     79182.1   11477.7
-10.00  0.0522     71811.0   11428.7
 -8.00  0.0522     66393.3   11411.6
 -6.00  0.0763     81901.8   11899.1
 -4.00  0.0923     77612.4   11389.1
 -2.00  0.0923     75361.0   11307.8
  0.00  0.0923     75218.4   11246.3
  2.00  0.0923     75374.2   11129.8
  4.00  0.0923     71328.9   10931.3
  5.00  0.0923     70097.4   10788.2
  6.00  0.0964     64896.8   10680.5
  7.00  0.0964     62136.8   10530.2
  8.00  0.0964     57439.8   10390.5
  9.00  0.0964     54196.3   10215.8
 10.00  0.0964     46981.3   10087.1
 11.00  0.1205     44473.7    9856.0
 11.75  0.1205     38942.8    9709.2
 12.00  0.1205     40546.4    9672.0
 12.25  0.1205     37192.2    9583.4
 12.50  0.0964     41052.3    9496.2
 12.75  0.0964     27991.3    9956.8
 13.00  0.0964     27901.6   10004.2
 14.00  0.0964     26494.4    9963.9
 15.00  0.0964     24419.3    9921.3
 16.00  0.0964     22478.7    9867.3
 17.00  0.1205     20529.5    9816.7
 18.00  0.1205     19040.4    9734.2
 20.00  0.2088     19999.0    9562.2
 13.00  0.0964     28316.6    9960.8
 12.75  0.0964     28617.1    9948.4
 12.50  0.0964     29046.5    9987.6
 12.25  0.0964     29069.2    9961.9
 12.00  0.0964     42701.3    9561.9
 11.75  0.0964     41031.4    9504.7
 11.50  0.1205     41810.4    9717.8
 11.25  0.1205     41225.4    9817.6
 11.00  0.1205     43749.8    9846.2
 10.75  0.1205     43019.8    9911.6
```

5.30 Re6c LM standard LER. ZZ 2% -

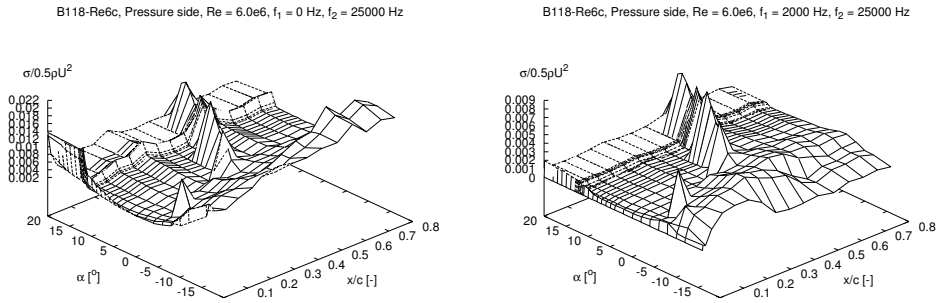

Figure 409: Pressure standard deviations, σ

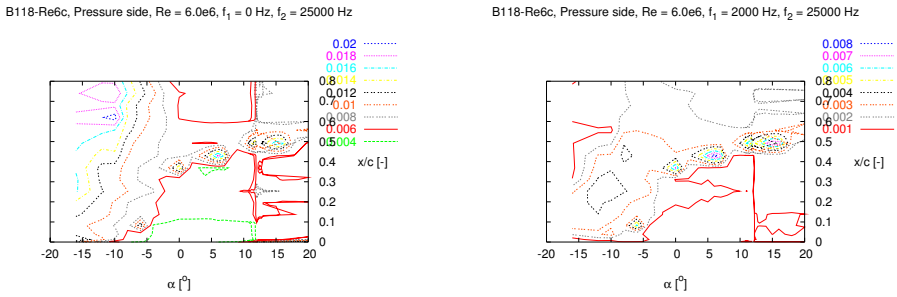

Figure 410: Contours of σ

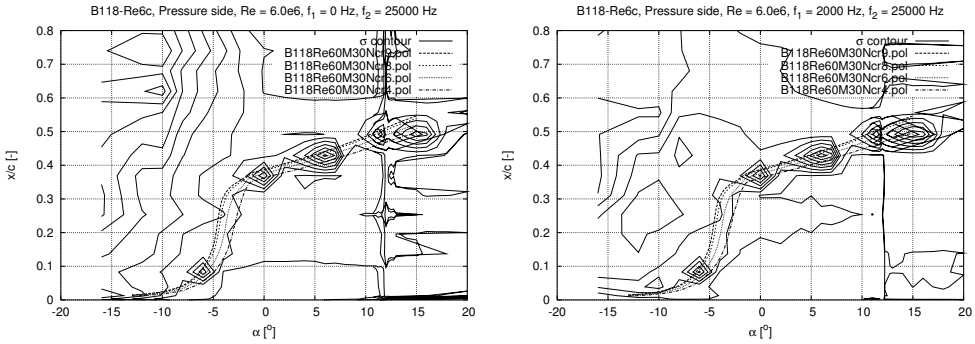

Figure 411: Contours of σ and XFoil data

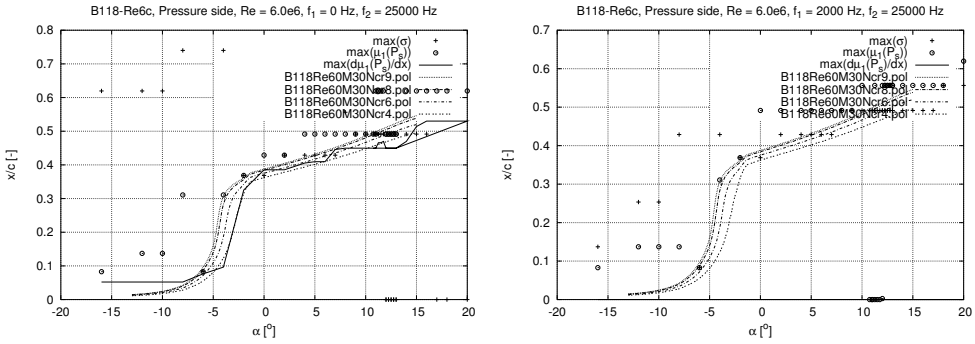

Figure 412: Transition detection

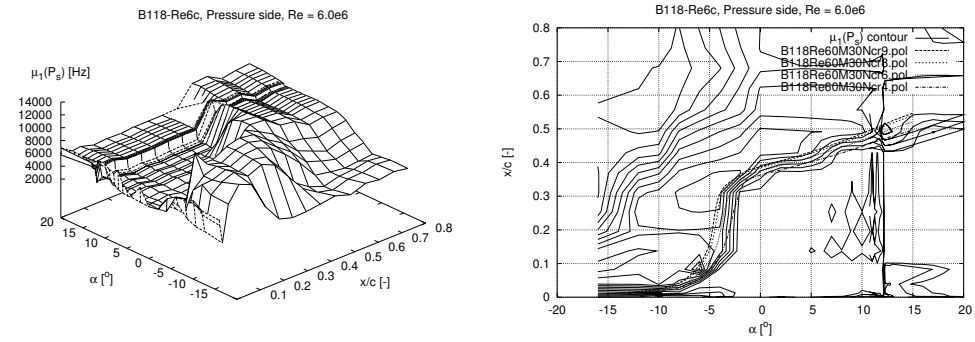

Figure 413: Fourier transform mean, $\mu_1(P_s)$

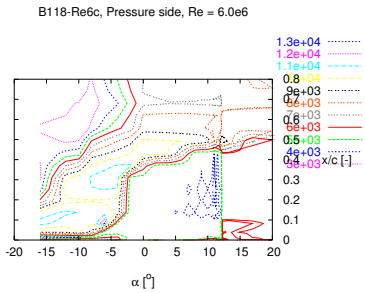

Figure 414: Contours of $\mu_1(P_s)$

```
B118-Re6c
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0522     91105.3   11385.7
-12.00  0.0522     78710.4   11175.7
-10.00  0.0522     73384.5   10975.0
 -8.00  0.0522     66367.3   11146.7
 -6.00  0.0763     81337.9   13092.9
 -4.00  0.0964     62208.5   11416.0
 -2.00  0.3252     78549.7   11152.9
  0.00  0.3855     55686.6   10474.6
  2.00  0.3855     70607.1   10377.7
  4.00  0.4055     64007.9   10076.2
  5.00  0.4095     60132.3   10030.4
  6.00  0.4095     48411.5   10001.3
  7.00  0.4457     54769.6    9964.5
  8.00  0.4497     66150.4    9951.7
  9.00  0.4497     67967.5    9839.9
 10.00  0.4497     60184.3    9383.3
 11.00  0.4497     47959.5    8017.3
 11.25  0.4658     41103.3    8002.3
 11.50  0.4658     40709.4    7995.6
 11.75  0.4698     34728.1    7974.6
 12.00  0.4497     60157.1    9386.7
 12.25  0.4497     43509.9    9473.9
 12.50  0.4497     41415.6    9286.1
 12.75  0.4497     39546.8    9124.6
 13.00  0.4497     36543.8    8885.2
 14.00  0.4698     25999.7    8615.4
 15.00  0.5139     24705.4    8693.1
 16.00  0.5300     34411.5    8771.1
 17.00  0.5300     44222.1    8798.4
 18.00  0.5300     41685.7    8783.7
 20.00  0.5300     36064.4    8790.7
 13.00  0.4497     38444.9    9006.7
 12.75  0.4497     40705.0    9161.4
 12.50  0.4497     42705.1    9337.7
 12.25  0.4497     44773.1    9525.2
 12.00  0.4497     60272.4    9462.1
 11.25  0.4497     43480.2    7961.3
 11.00  0.4497     47457.3    8021.3
 10.75  0.4497     49239.9    8389.4
```

5.31 Re6d Trip wire. Bump tape 2% -

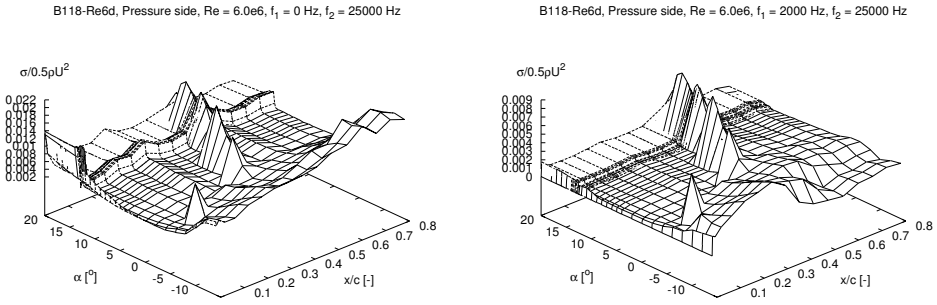

Figure 415: Pressure standard deviations, σ

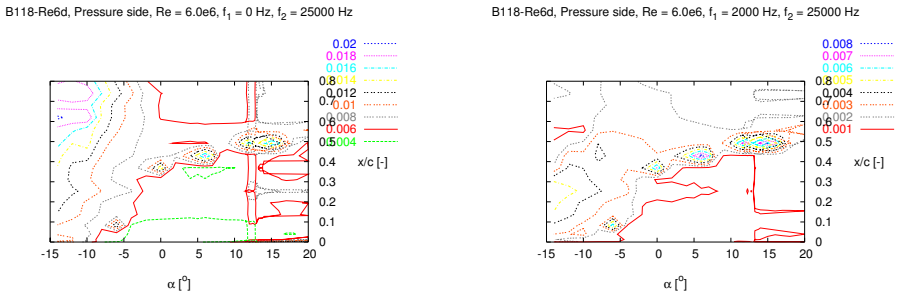

Figure 416: Contours of σ

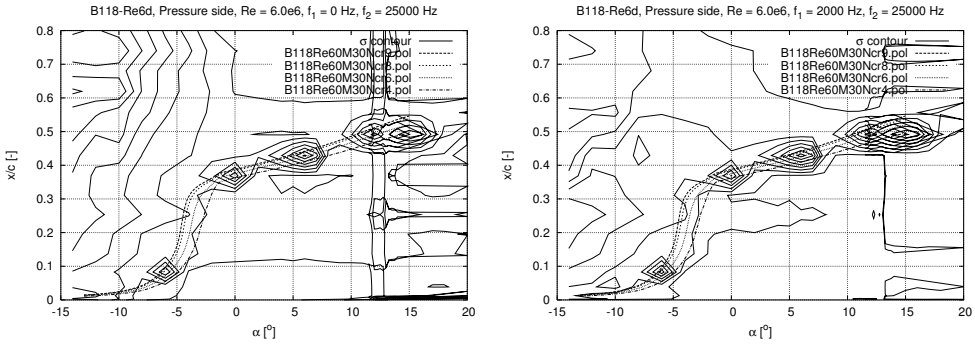

Figure 417: Contours of σ and XFoil data

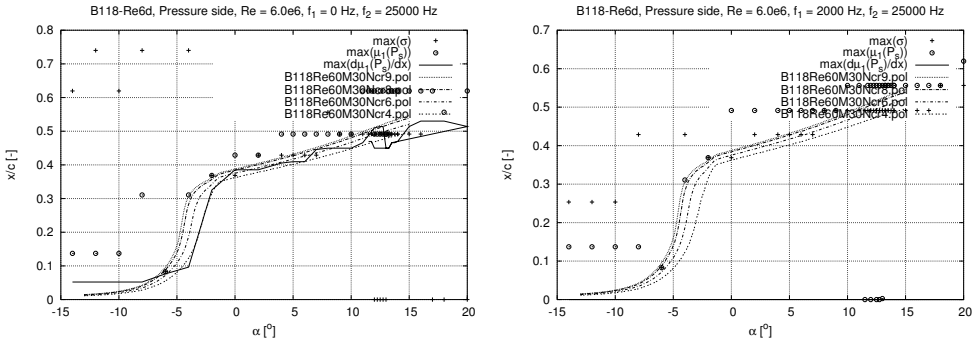

Figure 418: Transition detection

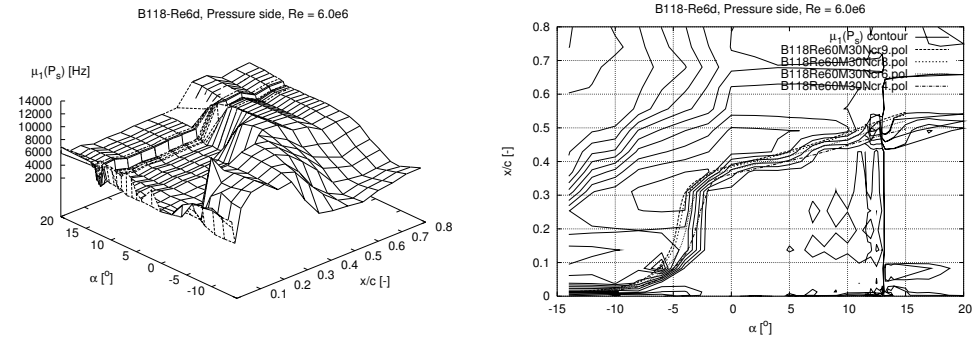

Figure 419: Fourier transform mean, $\mu_1(P_s)$

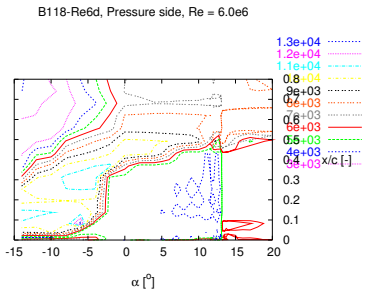

Figure 420: Contours of $\mu_1(P_s)$

```
B118-Re6d
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-14.00  0.0522     81366.9   11335.6
-12.00  0.0522     78386.1   11246.6
-10.00  0.0522     73911.8   11023.9
 -8.00  0.0522     66686.8   11210.0
 -6.00  0.0763     82818.1   13405.2
 -4.00  0.0964     62488.1   11428.4
 -2.00  0.3252     78867.4   11180.9
  0.00  0.3855     55829.1   10436.0
  2.00  0.3855     70161.1   10332.1
  4.00  0.4055     63746.3   10082.7
  5.00  0.4095     60004.3   10023.2
  6.00  0.4095     47609.5    9996.2
  7.00  0.4457     56077.5    9954.0
  8.00  0.4497     66616.4    9950.5
  9.00  0.4497     67612.7    9838.6
 10.00  0.4497     58386.5    9229.9
 11.00  0.4658     44440.1    8004.1
 12.00  0.5099     30476.8    7967.7
 12.50  0.5139     37969.5    7934.1
 12.75  0.5139     40939.4    7923.0
 13.00  0.4497     49673.7    8517.9
 13.25  0.4497     32282.3    8517.1
 13.50  0.4658     29462.0    8526.6
 14.00  0.4698     24901.2    8562.6
 15.00  0.5139     25742.3    8656.7
 16.00  0.5300     35536.4    8709.3
 17.00  0.5300     44572.7    8780.7
 18.00  0.5300     42013.8    8804.7
 20.00  0.5139     36872.9    8770.4
 14.00  0.4698     25534.1    8617.7
 13.75  0.4658     28411.4    8526.2
 13.50  0.4658     30696.8    8504.9
 13.25  0.4497     33826.9    8516.3
 13.00  0.4497     50689.7    8593.1
 12.75  0.4497     51806.6    8770.1
 12.50  0.4497     55537.3    8972.7
 12.25  0.4497     54348.5    9104.3
 12.00  0.4497     58420.0    9194.4
 11.75  0.4698     34176.4    7976.5
 11.50  0.4698     35964.2    8014.3
```

5.32 Re6f Clean 200x200

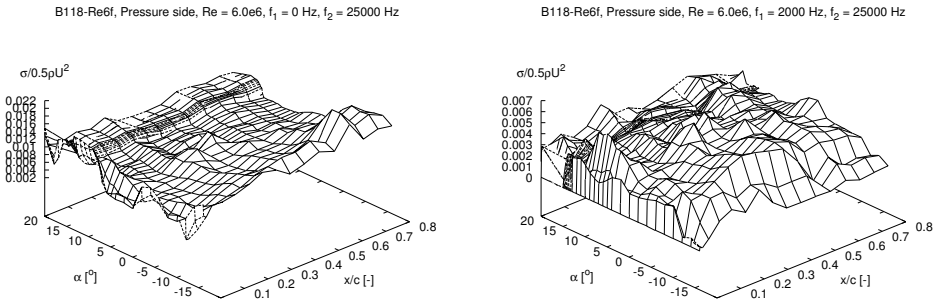

Figure 421: Pressure standard deviations, σ

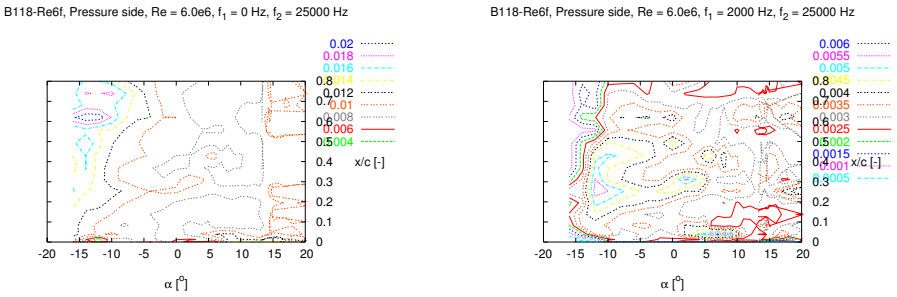

Figure 422: Contours of σ

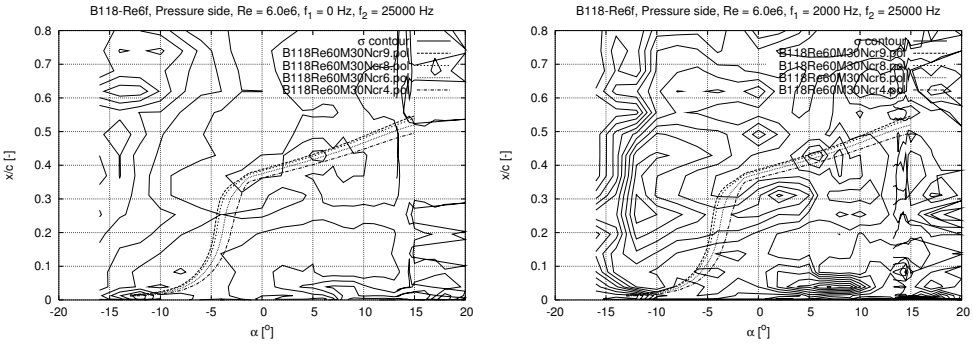

Figure 423: Contours of σ and XFoil data

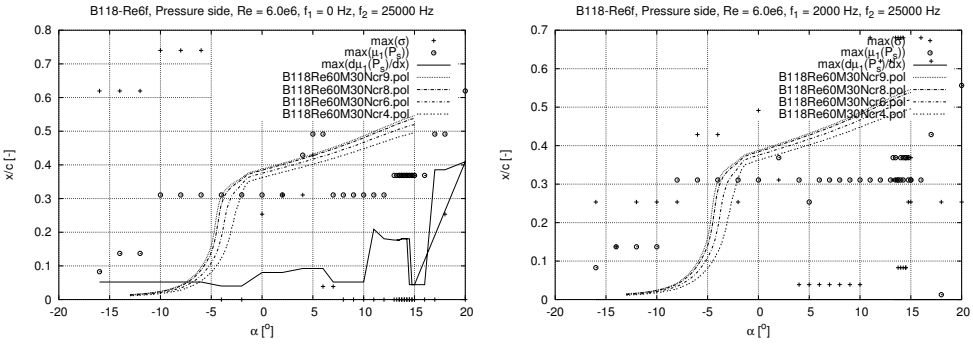

Figure 424: Transition detection

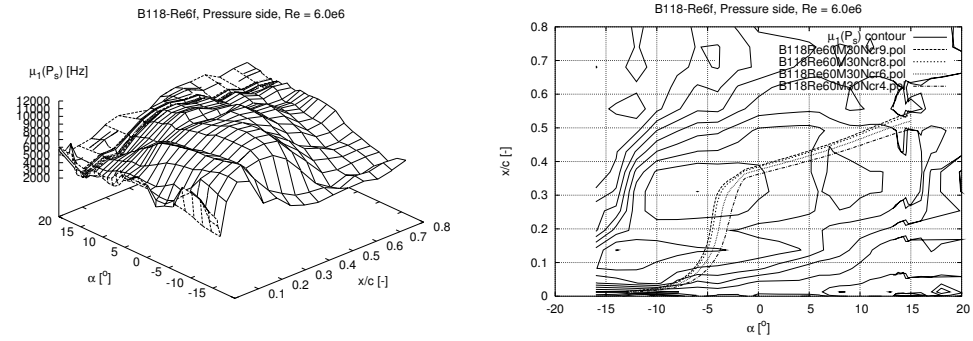

Figure 425: Fourier transform mean, $\mu_1(P_s)$

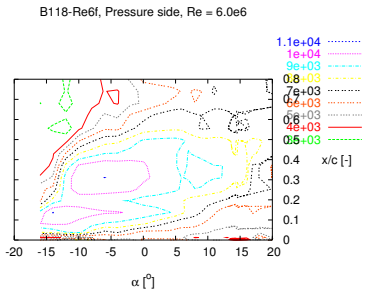

Figure 426: Contours of $\mu_1(P_s)$

```
B118-Re6f
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0522     70552.2    9988.0
-14.00  0.0522     76112.9   11028.9
-12.00  0.0522     70682.2   10782.1
-10.00  0.0522     60643.6   10557.5
 -8.00  0.0522     53834.1   10826.9
 -6.00  0.0522     47577.8   11004.4
 -4.00  0.0402     49214.0   10865.9
 -2.00  0.0402     53669.3   10739.6
  0.00  0.0803     42232.1   10208.9
  2.00  0.0803     37870.5    9807.4
  4.00  0.0923     34458.1    9606.0
  5.00  0.0923     32482.2    9376.2
  6.00  0.0923     27102.9    9212.2
  7.00  0.0522     26512.4    9098.4
  8.00  0.0522     30764.5    9808.3
  9.00  0.0522     26689.8    9608.1
 10.00  0.0522     19286.7    9246.0
 11.00  0.2088     20424.4    9059.2
 12.00  0.1807     23678.3    9026.6
 13.00  0.1767     25510.3    8953.6
 13.50  0.1767     24045.5    8712.8
 13.75  0.1807     22660.0    8511.1
 14.00  0.1807     22108.0    8444.7
 14.25  0.1807     22362.1    8398.2
 14.50  0.0442     21928.9    8692.2
 14.75  0.0442     23022.5    8595.9
 15.00  0.0442     21578.8    8589.1
 16.00  0.0442     21067.4    8446.8
 17.00  0.3855     16205.2    8206.7
 18.00  0.3855     13946.7    8101.7
 20.00  0.4095     17881.7    7749.8
 15.00  0.0442     20913.3    8587.9
 14.75  0.0442     20819.3    8541.6
 14.50  0.1807     21610.4    8314.8
 14.25  0.1807     22483.2    8420.0
 14.00  0.1807     22086.3    8434.1
 13.75  0.1807     22920.7    8551.7
 13.50  0.1767     22906.7    8620.9
 13.25  0.1767     24726.1    8852.0
```

5.33 Re6g ZZ90 x/c=5% suc. x/c=10% press. 200x200

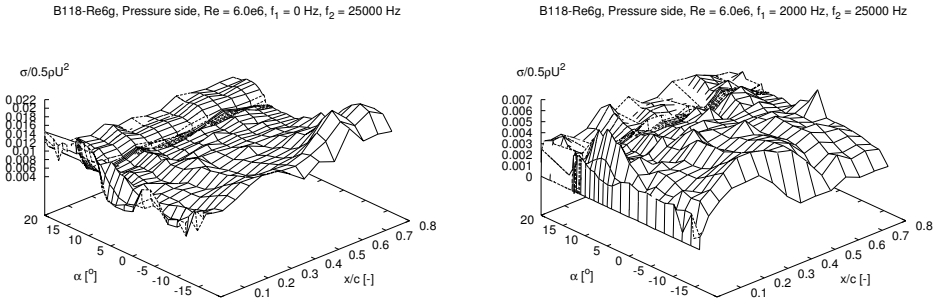

Figure 427: Pressure standard deviations, σ

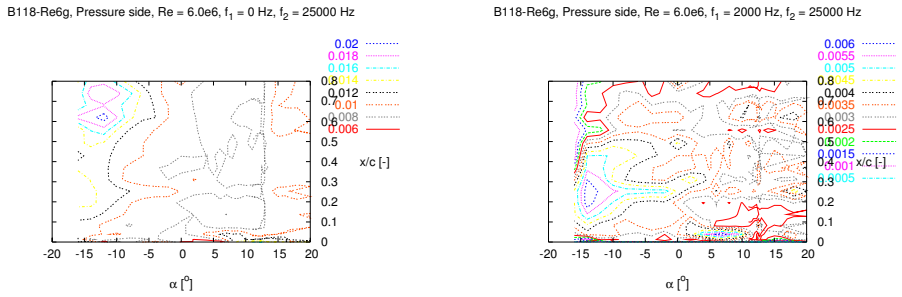

Figure 428: Contours of σ

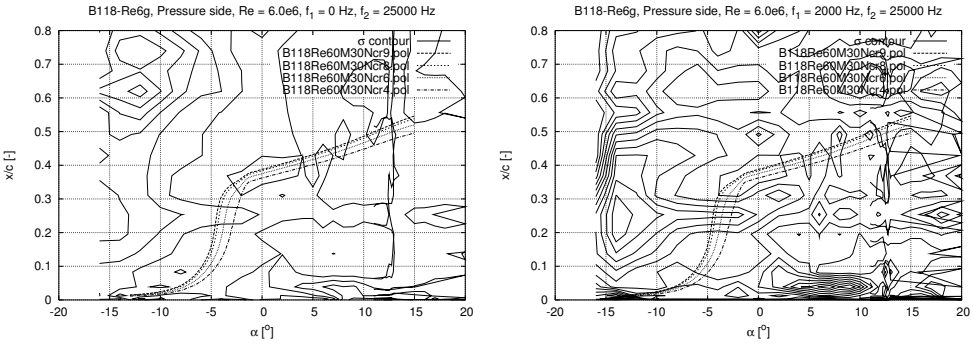

Figure 429: Contours of σ and XFoil data

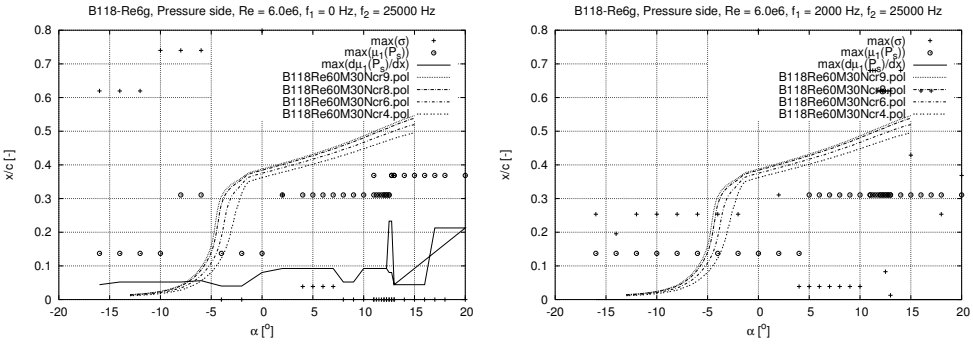

Figure 430: Transition detection

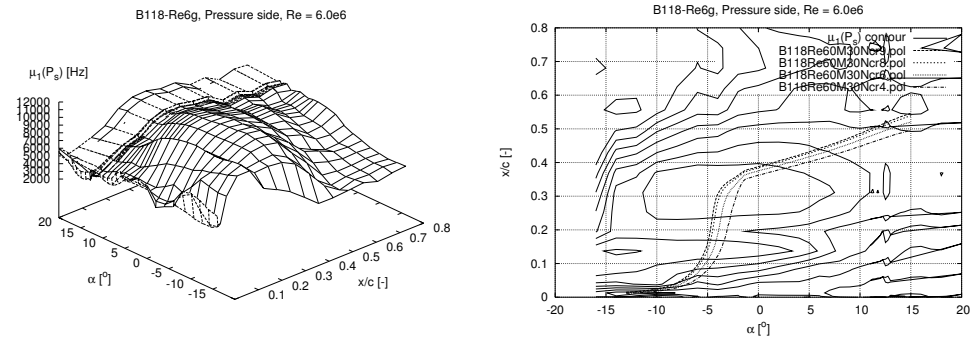

Figure 431: Fourier transform mean, $\mu_1(P_s)$

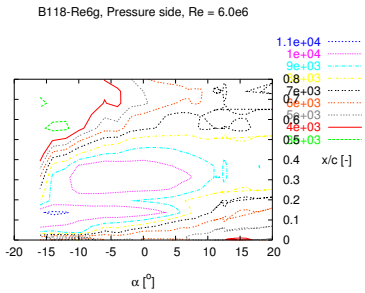

Figure 432: Contours of $\mu_1(P_s)$

```
B118-Re6g
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0442     66227.0   10914.7
-14.00  0.0522     71665.0   11136.3
-12.00  0.0522     68256.6   11060.1
-10.00  0.0522     61023.1   10781.1
 -8.00  0.0522     55131.2   10789.7
 -6.00  0.0562     49472.1   10959.5
 -4.00  0.0402     49241.9   10965.0
 -2.00  0.0402     53315.7   10864.7
  0.00  0.0803     51261.7   10666.3
  2.00  0.0923     47795.5   10422.8
  4.00  0.0923     43273.0   10307.6
  5.00  0.0923     40144.8   10273.6
  6.00  0.0923     35124.0   10217.5
  7.00  0.0923     27641.2   10085.5
  8.00  0.0522     29332.8    9910.1
  9.00  0.0522     25891.3    9630.6
 10.00  0.0923     21285.6    9277.6
 11.00  0.0923     21313.5    8994.0
 12.00  0.0923     20083.3    8988.4
 12.25  0.0923     19638.7    8959.7
 12.50  0.2329     18973.8    8926.3
 12.75  0.2329     19469.7    8914.8
 13.00  0.0442     19663.0    8989.1
 14.00  0.0442     23196.2    8753.6
 15.00  0.0442     22764.6    8648.0
 16.00  0.0442     19775.1    8664.2
 17.00  0.2128     21266.3    8903.9
 18.00  0.2128     22307.8    9010.0
 20.00  0.2128     22374.1    8877.5
 13.00  0.0442     23586.2    8983.9
 12.75  0.0803     18229.4    9144.4
 12.50  0.0803     19737.6    9210.8
 12.25  0.0923     20038.4    8970.1
 12.00  0.0923     20386.8    8980.7
 11.75  0.0923     21160.1    9010.1
 11.50  0.0923     21345.7    8982.7
 11.25  0.0923     21915.9    9010.4
 11.00  0.0923     21534.1    8996.3
```

5.34 Re6h LER. ZZ 2% 200x200

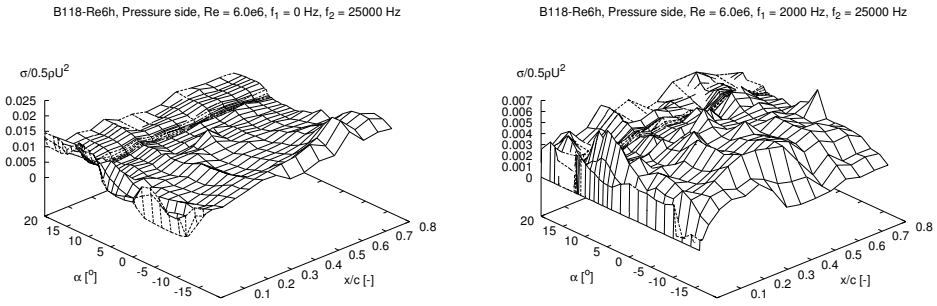

Figure 433: Pressure standard deviations, σ

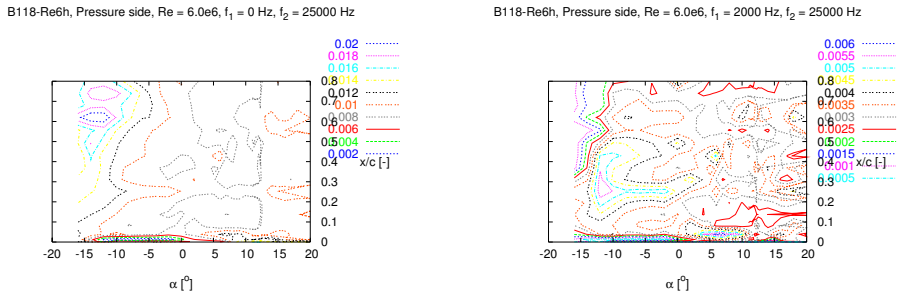

Figure 434: Contours of σ

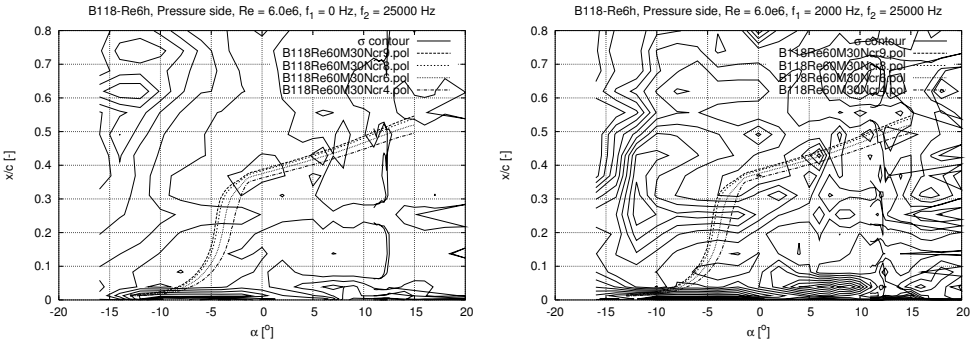

Figure 435: Contours of σ and XFoil data

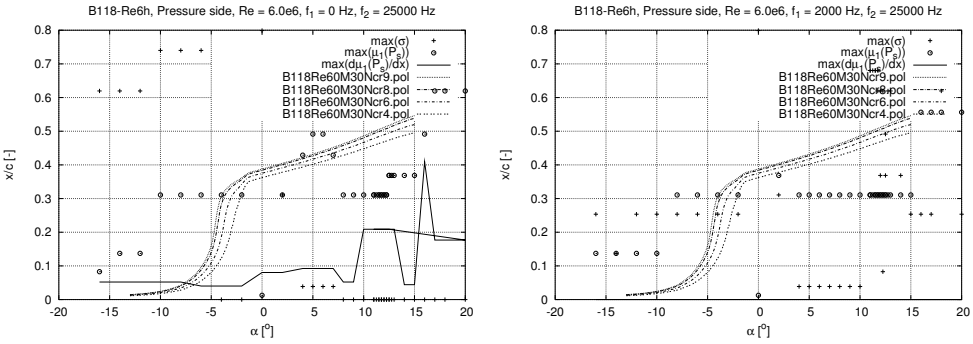

Figure 436: Transition detection

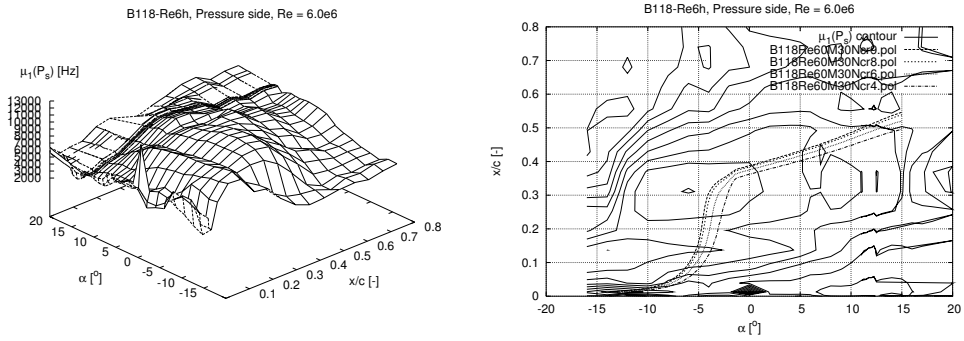

Figure 437: Fourier transform mean, $\mu_1(P_s)$

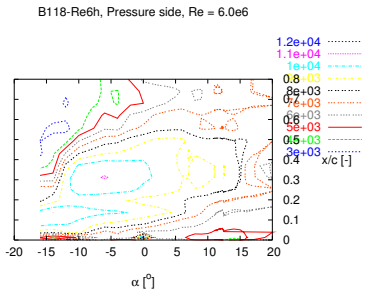

Figure 438: Contours of $\mu_1(P_s)$

```
B118-Re6h
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0522     66521.7   10572.5
-14.00  0.0522     79494.8   11001.6
-12.00  0.0522     68098.8   10803.1
-10.00  0.0522     53647.7   10597.4
 -8.00  0.0522     44918.3   10895.3
 -6.00  0.0402     44817.3   11049.3
 -4.00  0.0402     48621.0   10878.3
 -2.00  0.0402     52536.6   10768.8
  0.00  0.0803     42029.1   12447.8
  2.00  0.0803     38524.8    9883.5
  4.00  0.0923     34825.1    9589.3
  5.00  0.0923     32988.1    9385.2
  6.00  0.0923     28273.9    9276.8
  7.00  0.0923     22361.6    9096.6
  8.00  0.0522     27895.6    9786.1
  9.00  0.0522     23908.9    9623.2
 10.00  0.2088     18857.5    9310.3
 11.00  0.2088     19765.4    8993.9
 11.50  0.2088     20184.8    8933.0
 11.75  0.2088     20674.1    8900.0
 12.00  0.2088     20478.8    8884.8
 12.25  0.2088     20637.5    8796.1
 12.50  0.2088     19888.3    9034.8
 12.75  0.2088     19959.6    8982.6
 13.00  0.2088     19986.5    8899.5
 14.00  0.0442     21677.3    8787.5
 15.00  0.0442     17558.8    8266.5
 16.00  0.4095     14091.9    8047.9
 17.00  0.1767     14836.8    7903.3
 18.00  0.1767     15545.3    7926.2
 20.00  0.1767     17071.6    7958.6
 12.50  0.2088     19790.6    9009.7
 12.25  0.2088     20762.2    8799.4
 12.00  0.2088     20486.6    8851.6
 11.75  0.2088     20497.2    8901.6
 11.50  0.2088     20067.5    8932.5
 11.25  0.2088     20211.5    8946.5
 11.00  0.2088     19748.9    9043.5
```

5.35 Re6i Trip wire. Bump tape 0,1 2% 200x200

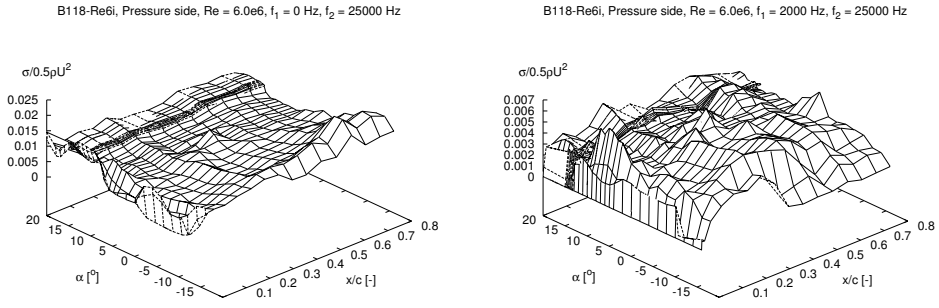

Figure 439: Pressure standard deviations, σ

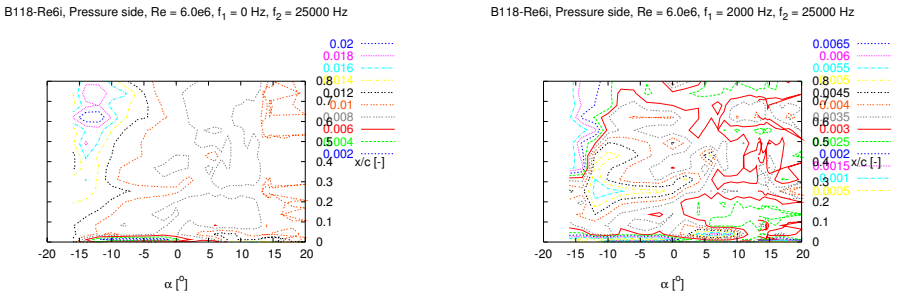

Figure 440: Contours of σ

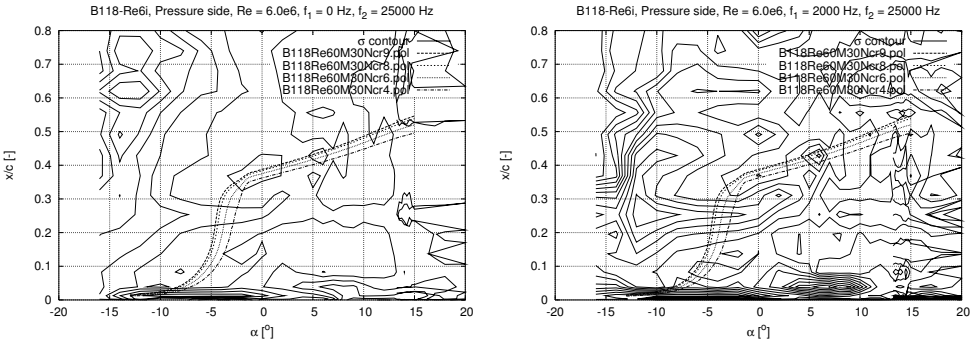

Figure 441: Contours of σ and XFoil data

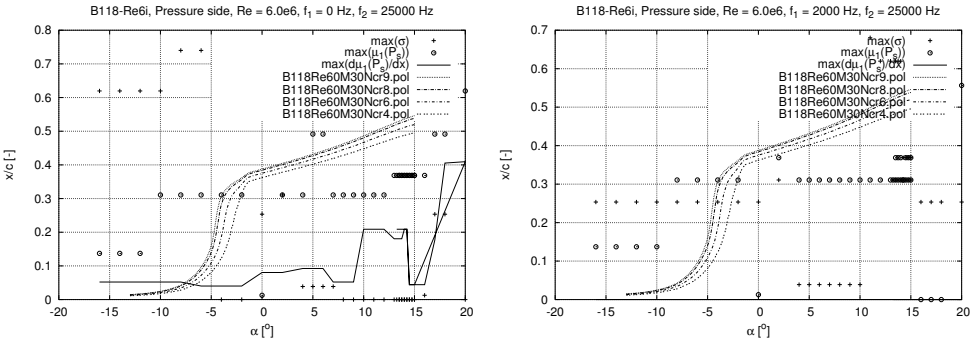

Figure 442: Transition detection

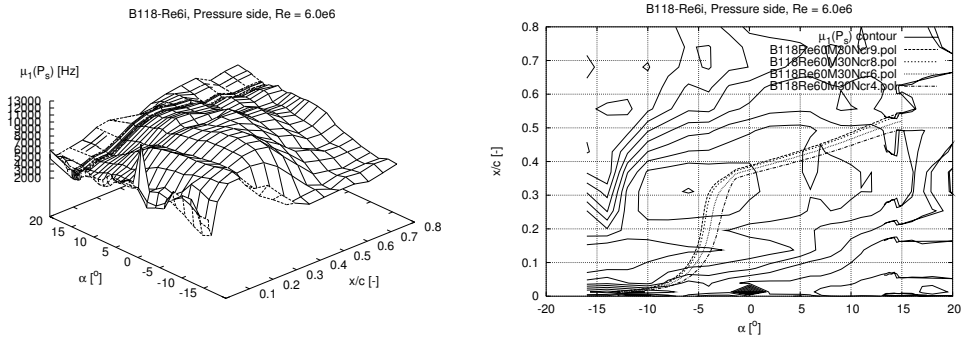

Figure 443: Fourier transform mean, $\mu_1(P_s)$

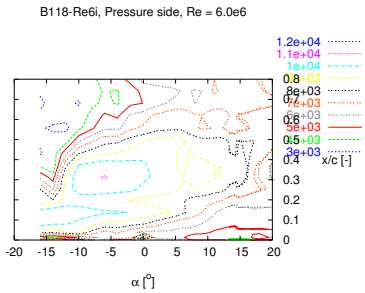

Figure 444: Contours of $\mu_1(P_s)$

```
B118-Re6i
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0522     76076.1   10614.2
-14.00  0.0522     79403.9   10986.6
-12.00  0.0522     68331.4   10830.4
-10.00  0.0522     54371.3   10564.2
 -8.00  0.0522     44986.9   10874.4
 -6.00  0.0402     44884.6   11048.5
 -4.00  0.0402     49366.7   10853.0
 -2.00  0.0402     52705.5   10749.9
  0.00  0.0803     42052.6   12488.5
  2.00  0.0803     38195.2    9806.1
  4.00  0.0923     34687.4    9584.6
  5.00  0.0923     32903.5    9407.9
  6.00  0.0923     27719.5    9275.9
  7.00  0.0522     24715.5    9198.7
  8.00  0.0522     28994.9    9819.5
  9.00  0.0522     25034.7    9604.5
 10.00  0.2088     18824.5    9293.3
 11.00  0.2088     20334.7    9003.6
 12.00  0.2088     22505.9    9013.6
 13.00  0.1807     22590.3    8703.2
 13.50  0.1807     20905.5    8419.4
 13.75  0.1807     20688.8    8409.6
 14.00  0.2088     20270.3    8364.4
 14.25  0.2088     20318.7    8383.0
 14.50  0.0442     22360.2    8635.8
 14.75  0.0442     20608.3    8633.7
 15.00  0.0442     22625.3    8604.1
 16.00  0.0442     19580.5    8287.7
 17.00  0.1767     12754.4    8020.0
 18.00  0.4055     13272.7    7935.6
 20.00  0.4095     13929.8    7821.4
 15.00  0.0442     22700.5    8629.9
 14.75  0.0442     22944.9    8649.1
 14.50  0.0442     20667.2    8329.2
 14.25  0.2088     20669.1    8366.6
 14.00  0.2088     20444.3    8372.6
 13.75  0.2088     20746.9    8440.7
 13.50  0.2088     19844.9    8428.0
 13.25  0.2088     20218.3    8521.8
```

5.36 Re6j Clean 100x100

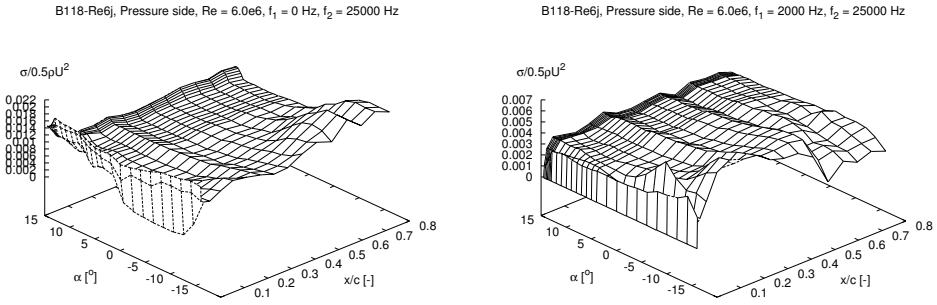

Figure 445: Pressure standard deviations, σ

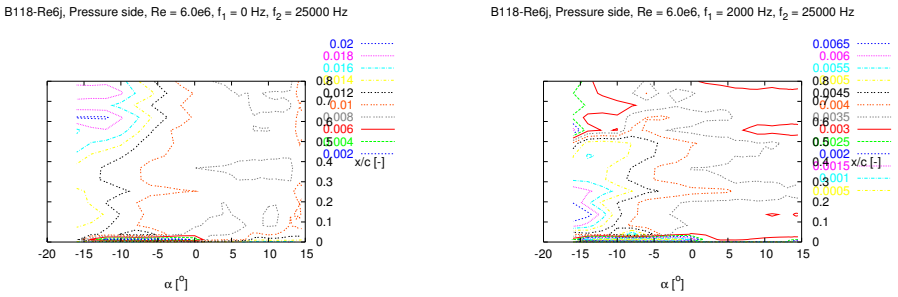

Figure 446: Contours of σ

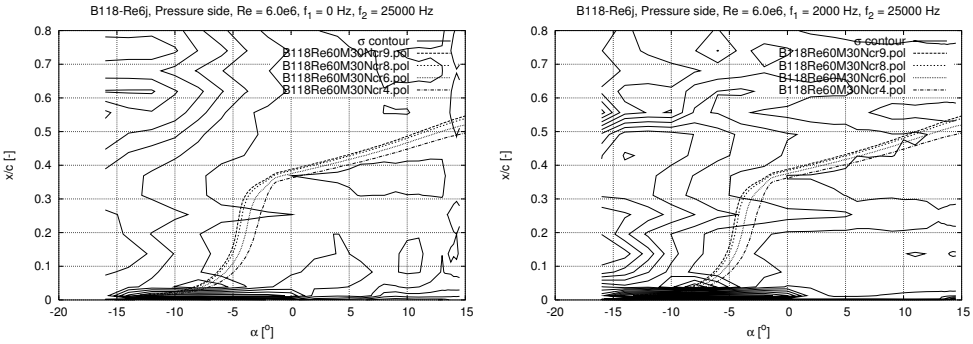

Figure 447: Contours of σ and XFoil data

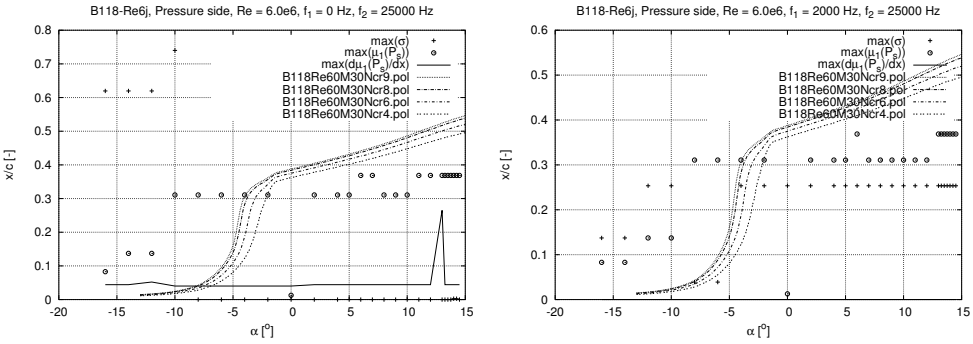

Figure 448: Transition detection

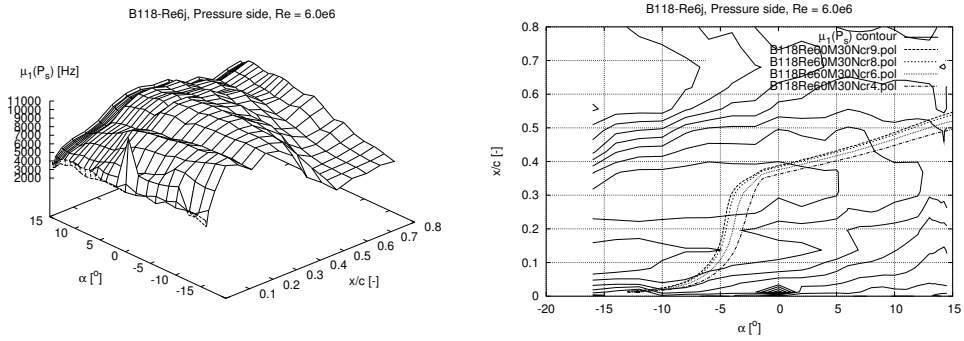

Figure 449: Fourier transform mean, $\mu_1(P_s)$

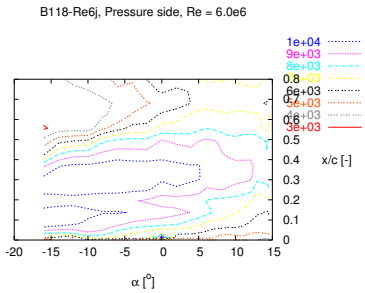

Figure 450: Contours of $\mu_1(P_s)$

```
B118-Re6j
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0442     70371.9   10962.9
-14.00  0.0442     63333.2   10792.7
-12.00  0.0522     64287.9   10744.8
-10.00  0.0402     53303.8   10599.0
 -8.00  0.0402     46814.4   10557.3
 -6.00  0.0402     54912.9   10823.7
 -4.00  0.0402     45366.3   10640.7
 -2.00  0.0402     49278.6   10567.4
  0.00  0.0402     49339.3   10652.0
  2.00  0.0442     44624.1   10365.6
  4.00  0.0442     36727.3   10179.3
  5.00  0.0442     34355.9   10133.7
  6.00  0.0442     29150.9    9495.6
  7.00  0.0442     30216.3    9760.0
  8.00  0.0442     31190.9    9705.1
  9.00  0.0442     28261.1    9479.6
 10.00  0.0442     23559.0    9296.1
 11.00  0.0442     19983.1    9284.9
 12.00  0.0442     19718.2    9255.0
 13.00  0.2650     16337.1    8658.9
 13.25  0.0442     17170.7    8584.8
 13.50  0.0442     18891.4    8534.1
 13.75  0.0442     21286.1    8469.7
 14.00  0.0442     23747.5    8535.9
 14.25  0.0442     25846.4    8438.2
 14.50  0.0442     27674.4    8667.7
```

5.37 Re6jII Clean 100x100

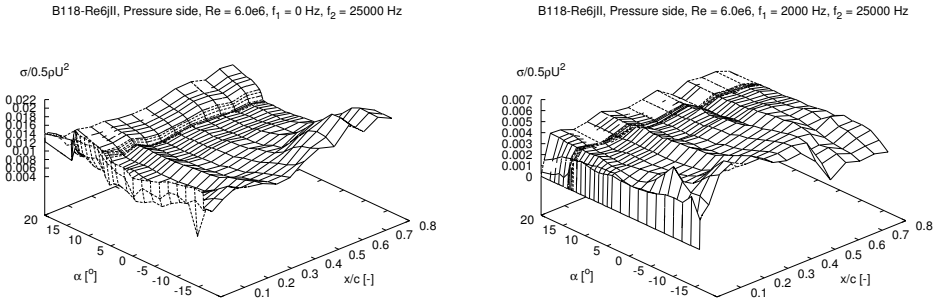

Figure 451: Pressure standard deviations, σ

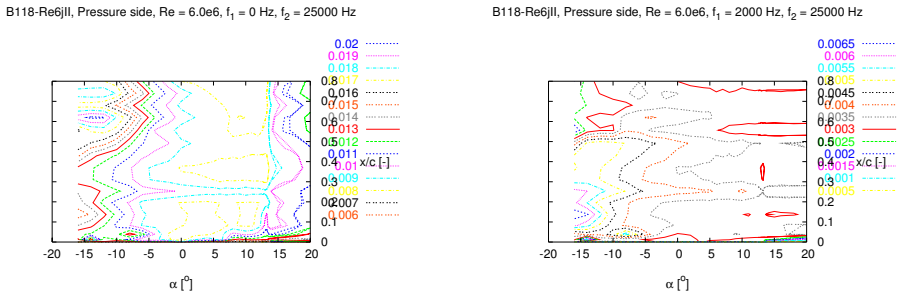

Figure 452: Contours of σ

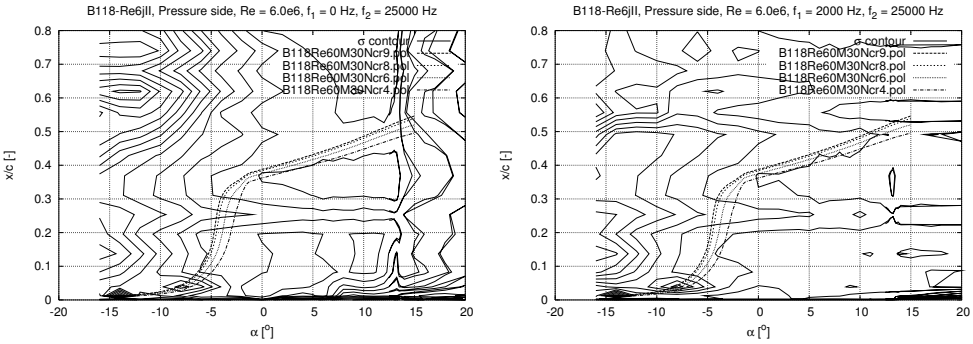

Figure 453: Contours of σ and XFoil data

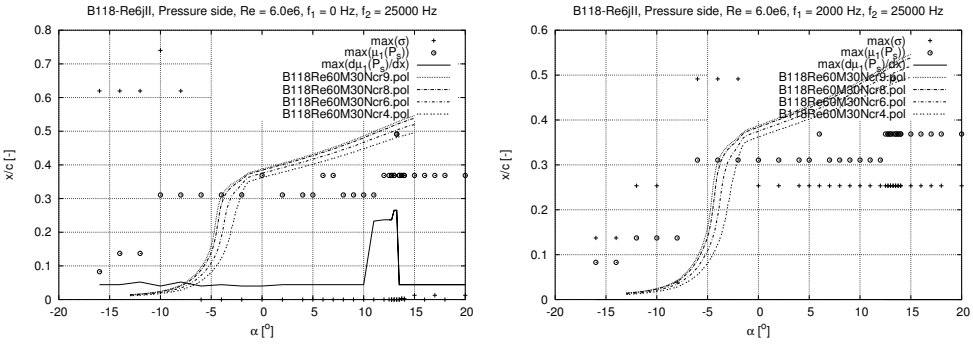

Figure 454: Transition detection

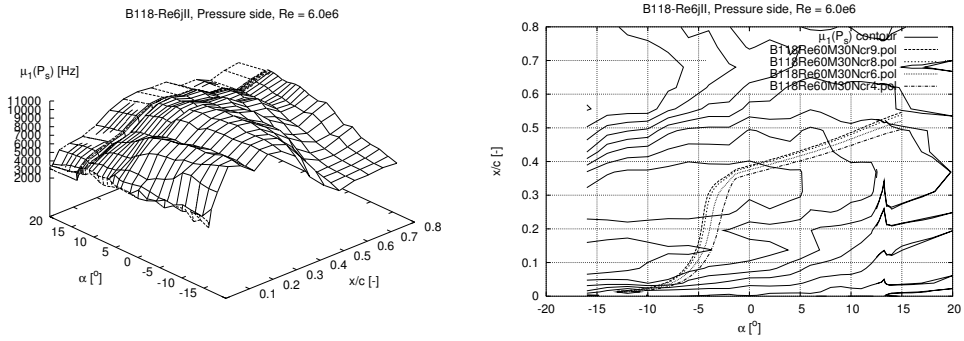

Figure 455: Fourier transform mean, $\mu_1(P_s)$

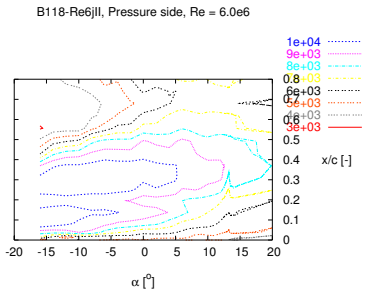

Figure 456: Contours of $\mu_1(P_s)$

```
B118-Re6jII
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0442     70461.3   10993.3
-14.00  0.0442     64043.5   10736.1
-12.00  0.0522     69774.4   10769.1
-10.00  0.0402     54059.4   10628.4
 -8.00  0.0522     52197.9   10571.4
 -6.00  0.0402     55916.3   10873.9
 -4.00  0.0442     47075.2   10706.7
 -2.00  0.0402     50048.2   10612.8
  0.00  0.0402     50474.0   10445.0
  2.00  0.0442     44959.9   10404.1
  4.00  0.0442     36748.5   10218.8
  5.00  0.0442     33624.8   10161.4
  6.00  0.0442     28863.0    9483.0
  7.00  0.0442     29926.5    9760.7
  8.00  0.0442     30470.7    9741.0
  9.00  0.0442     28323.1    9532.5
 10.00  0.0442     23023.1    9322.3
 11.00  0.2329     18721.7    9288.7
 12.00  0.2369     19392.8    9245.6
 12.75  0.2369     17137.4    8838.8
 13.00  0.2650     15420.1    8500.6
 13.25  0.2650     14094.1    8392.2
 13.50  0.0442     19220.8    8858.3
 13.75  0.0442     22486.2    8741.4
 14.00  0.0442     24812.6    8767.2
 15.00  0.0442     28202.7    8543.1
 16.00  0.0442     26116.1    8447.1
 17.00  0.0442     27390.7    8328.5
 18.00  0.0442     27153.6    8197.8
 20.00  0.0442     24450.4    7978.6
 14.00  0.0442     28623.8    8770.7
 13.75  0.0442     22885.2    8770.4
 13.50  0.0442     19359.0    8741.5
 13.25  0.2650     14041.4    8394.1
 13.00  0.2650     15364.0    8536.1
 12.75  0.2369     17317.7    8834.6
 12.50  0.2369     18743.0    9057.0
```

5.38 Re6k ZZ90 x/c=5% suc. x/c=10% press. 100x100

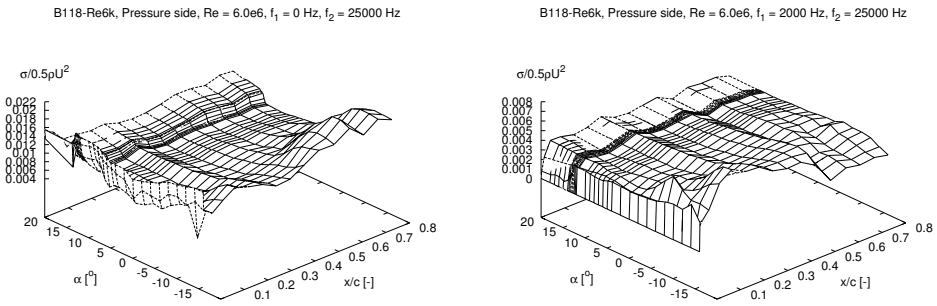

Figure 457: Pressure standard deviations, σ

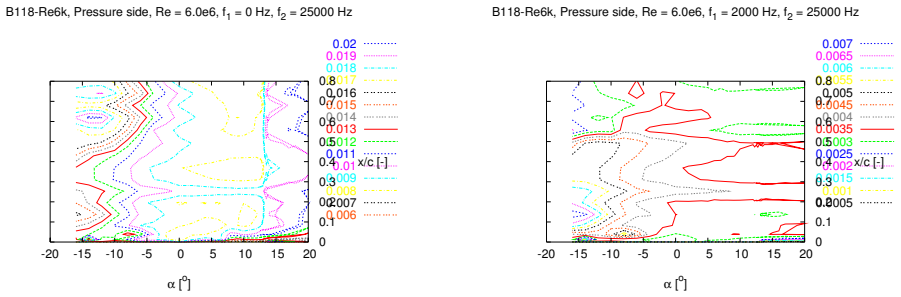

Figure 458: Contours of σ

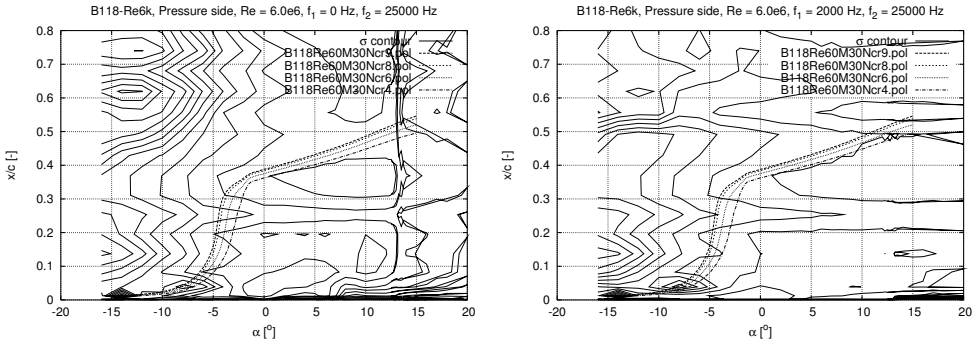

Figure 459: Contours of σ and XFoil data

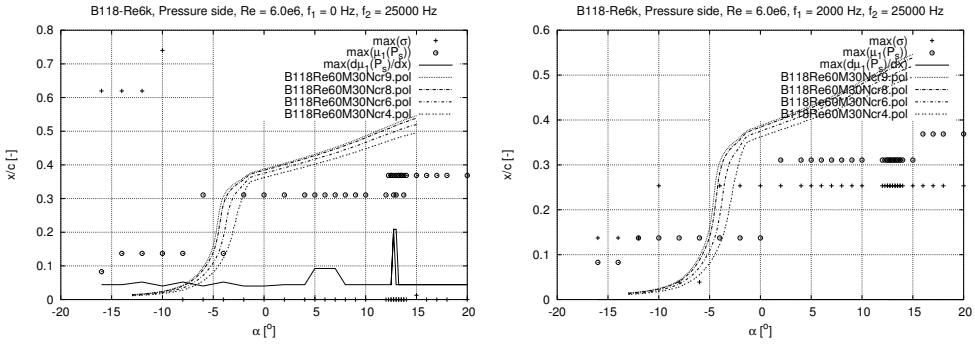

Figure 460: Transition detection

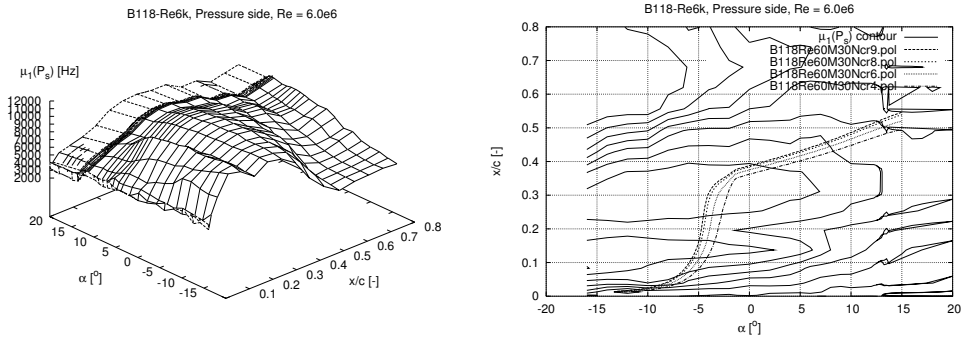

Figure 461: Fourier transform mean, $\mu_1(P_s)$

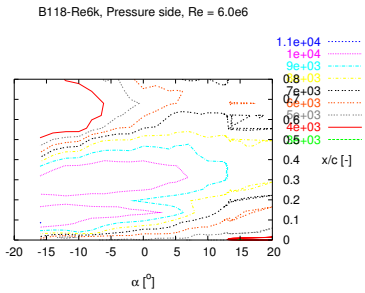

Figure 462: Contours of $\mu_1(P_s)$

```
B118-Re6k
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
-16.00  0.0442     70444.4   11040.6
-14.00  0.0442     65623.0   10975.5
-12.00  0.0522     70526.5   10992.3
-10.00  0.0402     54878.2   10695.9
 -8.00  0.0522     53325.6   10565.4
 -6.00  0.0402     56710.7   10760.6
 -4.00  0.0522     48359.4   10733.4
 -2.00  0.0402     50450.3   10554.9
  0.00  0.0402     50957.8   10566.1
  2.00  0.0442     45721.3   10354.6
  4.00  0.0442     37707.9   10204.1
  5.00  0.0923     36863.4   10195.1
  6.00  0.0923     34926.9   10097.0
  7.00  0.0923     30939.3    9989.7
  8.00  0.0442     30958.6    9779.1
  9.00  0.0442     28515.2    9564.8
 10.00  0.0442     24354.9    9313.8
 12.00  0.0442     19206.9    9195.1
 12.25  0.0442     18652.8    9196.8
 12.50  0.0442     18570.4    9172.1
 12.75  0.2088     18223.7    9111.1
 13.00  0.0442     19387.6    8931.3
 13.25  0.0442     26548.8    8841.1
 13.50  0.0442     25554.6    8849.2
 13.75  0.0442     27590.2    8731.6
 14.00  0.0442     29312.6    8691.8
 15.00  0.0442     30667.4    8570.9
 16.00  0.0442     27898.4    8470.3
 17.00  0.0442     25414.8    8427.6
 18.00  0.0442     27957.4    8409.4
 20.00  0.0442     23423.8    8346.4
 13.75  0.0442     30199.8    8803.7
 13.50  0.0442     26121.5    8580.6
 13.25  0.0442     21757.2    8745.7
 13.00  0.2088     18220.3    9083.9
 12.75  0.2088     18251.8    9117.6
 12.50  0.0442     18666.3    9175.0
```

5.39 Re6m Trip wire. Bump tape 0,1 2% 100x100

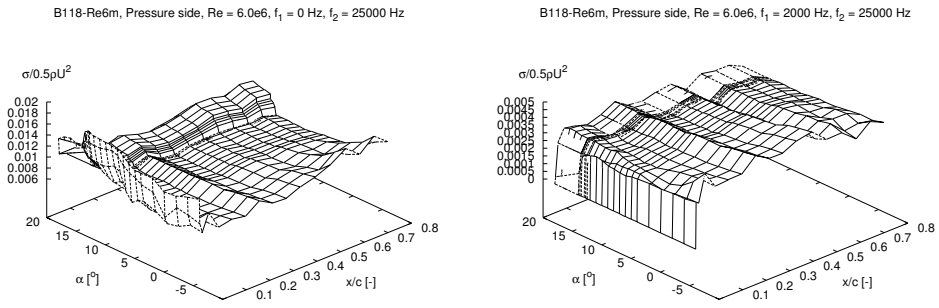

Figure 463: Pressure standard deviations, σ

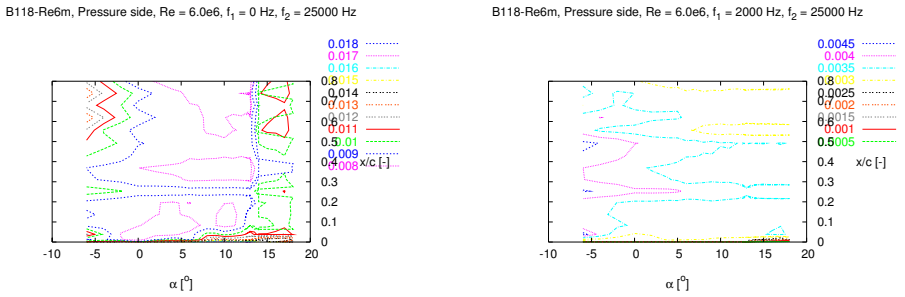

Figure 464: Contours of σ

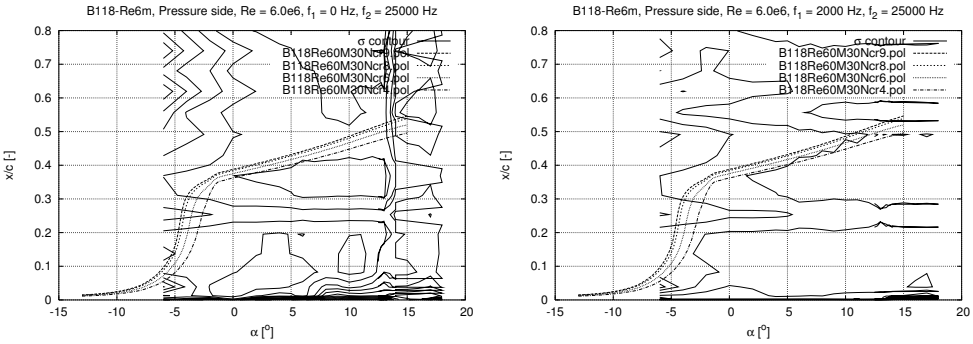

Figure 465: Contours of σ and XFoil data

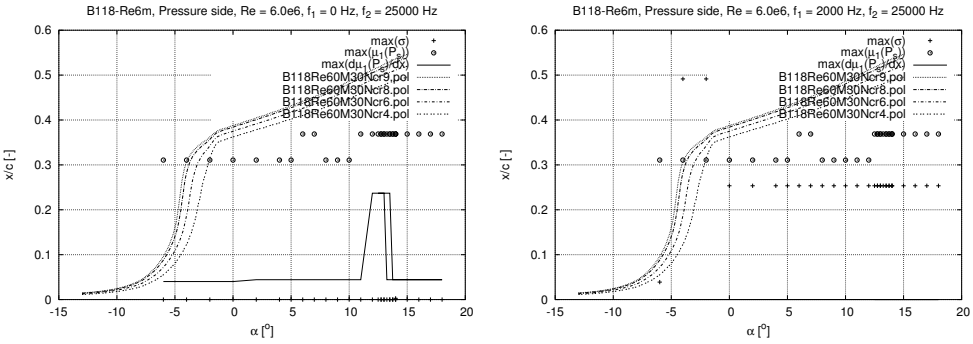

Figure 466: Transition detection

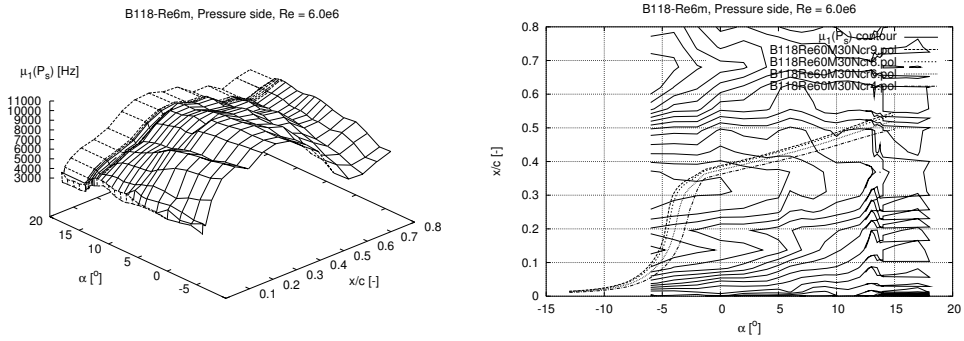

Figure 467: Fourier transform mean, $\mu_1(P_s)$

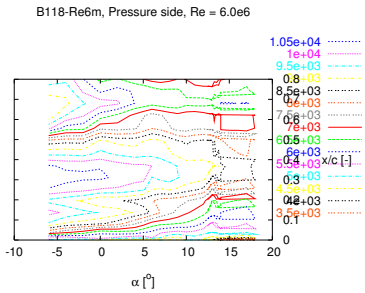

Figure 468: Contours of $\mu_1(P_s)$

```
B118-Re6m
alpha          [degrees] angle of attack
xtr*           [-]       transition point (x*=x/c) predicted by max[d(mu1(Ps))/dx*]
d(mu1)/dx*     [Hz/-]    d(mu1(Ps))/dx* evaluated at xtr* (=max[d(mu1(Ps))/dx*])
max(mu1)       [Hz]      max mu1 of all chordwise positions

alpha   xtr*    d(mu1)/dx*  max(mu1)
------  ------  ----------  --------
 -6.00  0.0402     58757.0   10836.4
 -4.00  0.0402     48391.7   10655.4
 -2.00  0.0402     50363.6   10580.8
  0.00  0.0402     50667.3   10603.1
  2.00  0.0442     45065.6   10389.2
  4.00  0.0442     37874.2   10205.1
  5.00  0.0442     34717.3   10186.4
  6.00  0.0442     30440.8    9996.8
  7.00  0.0442     30569.7    9882.4
  8.00  0.0442     30986.3    9748.0
  9.00  0.0442     28451.3    9525.6
 10.00  0.0442     23319.5    9309.0
 11.00  0.0442     19040.6    9264.2
 12.00  0.2369     19240.7    9258.2
 12.75  0.2369     18104.9    9157.7
 13.00  0.2369     16662.0    9132.6
 13.25  0.0442     18358.1    8869.2
 13.50  0.0442     24186.2    8938.5
 13.75  0.0442     24713.3    8856.9
 14.00  0.0442     27265.6    8771.9
 14.00  0.0442     27796.2    8566.0
 15.00  0.0442     28897.5    8442.6
 16.00  0.0442     27917.9    8335.6
 17.00  0.0442     27084.5    8251.9
 18.00  0.0442     30987.7    8747.0
 14.00  0.0442     25980.6    8861.0
 13.75  0.0442     22005.2    9002.9
 13.50  0.2369     16490.2    8954.1
 13.00  0.2369     17007.5    9121.2
 12.75  0.2369     18233.8    9175.2
 12.50  0.2369     18801.8    9184.0
```

References

[1] Døssing M. High Frequency Microphone Measurements for Transition Detection on Airfoils. Risø R-report ISBN 978-87-550-3674-1, Risø DTU, Wind Energy Department, 2008.

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Research targets are set through continuous dialogue with business, the political system and researchers.

The effects of our research are sustainable energy supply and new technology for the health sector.